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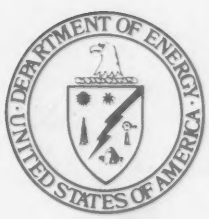

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ENERGY RESEARCH ABSTRACTS

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ENERGY RESEARCH ABSTRACTS

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56009 (MC—81NO-7) Evaluation of the potential of peat in Ontario. (Monenco Consultants Ltd., Rexdale, Ontario (Canada); Alberta/Canada Energy Resources Research Fund, Edmonton). 1982. 193p. (CE—01890). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report provides a detailed overall review of the possible uses and opportunities for development of Ontario's peat resources. Total peatland is estimated at 26 million hectares, of which only a tiny fraction is being mined. Complete peatland distribution maps show known deposits, and data on Ontario peat characteristics are presented, showing qualities comparable to northern European and Irish peat and suitability for horticultural and fuel peat production. Peat mining methods are reviewed, and the ones most suitable for Ontario production are noted. Conventional methods such as those used in Finland appear well suited to Ontario conditions. Peat mining equipment is evaluated, and it appears that Ontario-manufactured self-powered mining equipment, such as tractors, could be modified successfully for peat operations. Peat production costs are estimated at $18-24/tonne and the most suitable climates for peat mining are found in the south of the province. Peat processes and the corresponding technology are examined, including dewatering, drying, gasification, combustion, pyrolysis, and carbonization. Eight potential applications of peat were selected for analysis, and the ability of the peat products so produced to compete in the market was evaluated. It was determined that six uses of peat warrant investigation, including horticultural peat, and sod peat for heating and power generation. Some of these applications have potential for use in remote communities. Environmental and regulatory concerns are also discussed. Peatland development is not expected to cause severe or significant environmental impact. 208 refs., 86 figs., 76 tabs.

0103 Preparation

REFER ALSO TO CITATION(S) 56034, 56078

56010 (CIM—1988) A low-severity upgrading of subbituminous coals and heavy oils. Pawlak, W.; Turak, A.; Janiak, J.; Ignasiak, B. (Canadian Inst. of Mining and Metallurgy, Montreal, Quebec). 1988. 14p. (CONF-8805204—; CE—01924). Petroleum Society of the CIM, 229 - 640 Fifth Ave., S.W., Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

From 90. CIM annual general meeting; Edmonton, Canada (8 May 1988).

Laboratory-scale research conducted at the Alberta Research Council has resulted in development of the Agflotherm process. The process involves wil agglomeration of run-of-mine coal using suitable bridging liquids, followed by size enlargement of microagglomerates and then thermal treatment of agglomerates. The Agflotherm process employed for low quality subbituminous coals, and bitumen or heavy oil-based bridging liquids, results in generation of low-ash and moisture solid fuels, with a calorific value similar to that of bituminous coal, and asphaltene-free distillable crude. 4 refs., 5 tabs.

56011 (DOE/FC/10622—2583) Ultrafine grinding of low-rank coal: Phases II and III: Final report. Steele, W.G.; Bouchillon, C.W. (Mississippi State Univ., Mississippi State (USA)). Aug 1987. Contract AC21-84FC10622. 73p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88001087/JAW.

A study of ultrafine grinding of low-rank coals in a fluid-energy mill was undertaken. The overall project objectives were to (1) measure selected properties of ultrafine-pulverized, low-rank coal as a function of coal source and product moisture, and (2) determine the power requirements for a fluid-energy mill to produce {minus}10 micron sized particles as a function of coal source and product moisture. A fluid-energy mill which uses either air or steam as the pulverization medium at the Ergon, Inc. Micro-Energy Division development facility at Vicksburg, Mississippi, was used in this investigation. 19 refs., 40 figs., 24 tabs.

56012 (DOE/PC/79799—T6) The demonstration of an advanced cyclone coal combustor, with internal sulfur, nitrogen, and ash control for the conversion of a 23 MMBTU/hour oil fired boiler to pulverized coal: Fourth quarterly project progress report, January 1, to March 31, 1988. (Coal Tech Corp., Merion, PA (USA)). [1988]. Contract FC22-87PC79799. 10p. NTIS, PC A02/MF A01. Order Number DE89001386/JAW.

An advanced cyclone coal combustor for "new" or "retrofit" applications on industrial or utility boilers is being demonstrated. This advanced combustor demonstrates control of SO_2 and NO/sub x/ emissions to near new source performance standards and at the same time retains and rejects ash, sorbent, and sulfur compound solids as slag upstream of the boiler. During this period the Phase III effort was continued. Five separate tests were conducted covering almost 50 parametric condition variations. A total of 100 hours of combustor operation were completed. The main technical goals were to: improve coal combustion efficiency above the 80% level obtained earlier; achieve coal ash slagging within the combustor; and obtain good, blockage-free, rejection of slag through the combustor slag tap. Other project goals of staged combustion for NO/sub x/ control, as well as sulfur capture via limestone injection were implemented. All of these technical goals were substantially achieved during this reporting period.

56013 (DOE/PC/81208—T3) Microbially Augmented Ash and Pyrite Physical Separation (MAAPPS) process R and D: Final technical report. (ARCTECH, Inc., Alexandria, VA (USA)). May 1988. Contract AC22-85PC81208. 203p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE88009268/JAW.

The goal of this project was to develop a novel mechanism to microbially enhance removal of ash and pyrite from coals during flotation. Studies were conducted to: 1) evaluate the attachment of Thiobacillus ferrooxidans to pyrite and ash; 2) optimize the growth of T. ferrooxidans on pyrite enriched process wastes; 3) optimize flotation of three coals with and without microbial pretreatment; 4) demonstrate continuous growth of T. ferrooxidans on tailings; and 5) evaluate cell-free media for pretreatment of coal to reject pyrite and/or ash during flotation. An additional task was undertaken to evaluate the use of T. ferrooxidans in comminution of coal for selective liberation of pyrite and ash. Attachment studies indicated that T. ferrooxidans may attach to pyrite particles, and chemical alteration of pyrite surfaces as well as agglomeration of the pyrite optimization studies indicated that several medium components may be reduced or eliminated when T. ferrooxidans is grown on pyrite tailings. Optimization of the column and froth flotation units resulted in nearly complete removal of liberated pyrite, thus limiting the potential for enhanced removal using microbes. Thus, only marginal selective depression of ash and pyrite occurred when pretreating the coal with T. ferrooxidans. T. ferrooxidans was successfully cultured in a continuous fermentor with production of consistent biomass density, using pyrite enriched tailings. Marginal enhancement of ash and pyrite rejection occurred when pretreating coal with cell-free culture filtrates. Treatment of coal with T. ferrooxidans

over a period of days not only resulted in comminution but also in alteration of the characteristics of the coal mixture to achieve better mineral matter and sulfur rejection in some coals. 19 refs., 42 figs., 72 tabs.

0104 Processing

REFER ALSO TO CITATION(S) 56183, 57568

56014 **(ADI—NRCO20600) Report on a study on the biogasification of peat.** (Adi Ltd., Fredericton, New Brunswick (Canada)). Mar 1982. 84p. (CE—01908). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report presents a review of the literature on peat biogasification, a discussion of current US research, description of two promising biogasification processes with economic analyses, and an economic comparison with certain other peat utilization schemes. An annotated bibliography is included in an appendix. The following conclusions were reached. Biogasification of peat is technically feasible, based on the experimental studies done so far. Two processes which show promise are biogasification using alkaline-oxidative pretreatment developed by Dynatech, and the Biothermgas process. Both are in early stages of development; Biothermgas has been studied only with respect to other biomass and is thought to be applicable to wet-mined peat. A preliminary economic analysis and comparison with other peat utilization schemes showed that the lowest unit energy cost, exclusive of peat feedstock, was obtained by the Wet Carbonization Process, and the highest cost by the Dynatech process. When realistic operation and maintenance costs and scale factors were taken into account, the Biothermgas process became less economically attractive. This analysis suggests that densified peat production may also be economically attractive when done on a large scale. However, one must take into account that this process requires fuel-grade peat at a higher cost than peat used in other processes. The environmental impact of Biothermgas effluent is expected to be minimal, compared to the Dynatech process. Anaerobic digestion has potential in treatment of peat processing wastes. Recommendations are made regarding further research and process development. 22 refs., 4 figs., 18 tabs.

56015 **(CONF-880850—17) Sulfur emissions reduction at the Great Plains gasification project: A case for new technologies.** Doctor, R.D.; Wilzbach, K.E.; Levenson, J.B. (Argonne National Lab., IL (USA)). Aug 1988. Contract W-31109-ENG-38. 23p. NTIS, PC A03/MF A01. Order Number DE89000582/JAW.

From American Institute of Chemical Engineers summer national meeting; Denver, CO, USA (21 Aug 1988).

The Great Plains gasification plant in Beulah, North Dakota, uses 14 Lurgi gasifiers to produce 152 x 10^6 scf/d (5.57 x 10^6 Nm^3/d) of pipeline-quality gas from lignite. Since start-up in mid-1985, the plant has provided a serious challenge to the reliable operation of the Stretford sulfur recovery system. To address this challenge, over forty options for mitigating sulfur emissions were evaluated on an economic and technical basis, beginning at the emissions source (the stack) and working back through the plant. Although this study was directed toward providing a timely solution to the sulfur dioxide emissions problem, the status and opportunities for a number of emerging technologies were brought into focus. Specifically, technical challenges of liquid reduction-oxidation chemistries (such as Sulfolin and Stretford), Claus technologies, and the internal handling of coal-derived liquids need to be met for future synfuels facilities. 4 refs., 2 figs., 4 tabs.

56016 **(DOE/MC/21082—2597) Modeling and laboratory studies of electrolinking: Final report.** Dindi, H.; Krantz, W.B. (USDOE Morgantown Energy Technology Center, WV). Apr 1988. Contract AC21-84MC21082. 133p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88010258/JAW.

Dielectric breakdown (DEB) front propagation in solids is studied through asymptotic analysis and laboratory simulation. This phenomenon occurs in electrolinking, a process used to enhance coal permeability prior to underground coal gasification. An analytical model describing the propagation of a planar DEB front has been developed using the technique of matched asymptotic expansions. Simple expressions are derived which relate the propagation speed and temperature of the DEB front to the current density, physical properties of the medium, and process parameters. These expressions are than used to predict the electrolinking energy requirement. The model predictions were validated with laboratory experiments on solid samples of an Illinois Basin bituminous coal from the Herrin No. 6 seam. The propagation of electrolinks were monitored noninvasively during these experiments using infrared thermography. The effects of electrode diameter, electrode geometry, moisture, and saline solution injection on the size, propagation speed, and number of electrolinks were investigated. Only one electrolink was initiated when small electrodes were used. Multiple links were initiated when large electrodes were used. Higher voltages were required to electrolink dry coal samples than wet samples. Faster link propagation was observed when tap-water-saturated samples were substituted with 0.1 M KCl saturated coal samples. The electrolinked coal samples were examined for structural changes using scanning electron microscopy. These modeling and laboratory studies indicate that the reliability and economics of electrolinking can be improved by concentrating the current with shaped electrodes and by reducing the coal resistivity by injecting saline solutions. 65 refs., 40 figs., 9 tabs.

56017 **(DOE/MC/21376—2590) Expansion of high-temperature, high-pressure data set for coal gasification: Final report.** Jenkins, R.G.; Scaroni, A.W.; Fatemi-Badi, M.; Lee, C.W. (Pennsylvania State Univ., University Park (USA). Dept. of Materials Science and Engineering). Feb 1988. Contract AC21-84MC21376. 276p. NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE88001097/JAW.

Although synthetic fuel technologies have been the subject of many investigations over the last several decades and important advances have been made in this technology, it is still not an economical source of energy. To advance synthetic fuel technology into a more feasible and economically compatible technology, further understanding of reaction mechanisms and product formation in relation to processing condition is essential. Pyrolysis is a key element in nearly all coal conversion processes. This is the first step in gasification, the step which controls the production of tar, char and volatile gases, the chemical composition of these products, and the physical structure and reactivity of the chars. Therefore, to advance gasification technologies, data are needed on the effect of coal properties and operating variables during the devolatilization processes, especially at high-temperature and high-pressure conditions using an entrained-flow technique. To obtain data and meaningful detailed information in the area of high-temperature, high-pressure coal devolatilization in an entrained-flow reactor, a comprehensive study was conducted using samples of Montana Rosebud subbituminous and Illinois No. 6 bituminous coals. Although there are several independent variables that affect product yields and compositions, it was impractical to systematically investigate them all. Therefore, the scope of this study was limited to only two of the variables, pressure and residence time. The other variables, such as temperature, particle heating rate, particle size, coal type, etc., were held as uniform as possible throughout the study. All the data reported here were obtained in inert atmosphere of nitrogen. 118 figs., 30 tabs.

56018 **(DOE/MC/23260—2553) Disposal of off-gases from hot gas desulfurization processes: Yearly technical status report.** Gangwal, S.K.; Harkins, S.M.; Woods, M.C. (USDOE Morgantown Energy Technology Center, WV; Research Triangle Inst., Research Triangle Park, NC (USA)). Oct 1987. Contract AC21-86MC23260. 63p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88001055/JAW.

The results from the first year of a 2-year study entitled {open←quotes}Disposal of Off-Gases from Hot Gas Desulfurization Processes{close←quotes} are presented in this report. The work was performed by the Center for Process Research at Research Triangle Institute under Contract AC21-86MC23260 with Morgantown Energy Technology Center (METC) of the US Department of Energy. High temperature desulfurization processes being developed by METC involve the use of regenerable mixed

metal compounds such as zinc ferrite for efficient removal of reduced sulfur compounds from coal gasifier gases. 10 refs., 20 figs., 9 tabs.

56019 **(DOE/PC/60813—15) Hydrotreatment catalyst activity enhancement: Final report for the period August 1, 1983--March 31, 1987.** Seapan, M.; Crynes, B.L. (Oklahoma State Univ., Stillwater (USA). School of Chemical Engineering). Jan 1988. Contract FG22-83PC60813. 406p. NTIS, PC A18/MF A01; 1; GPO Dep. Order Number DE88008511/JAW.

This project originated from an earlier observation that addition of titanocene dichloride to an SRC-II light oil resulted in a moderate reduction in catalyst coking and a significant increase in the hydrotreatment activity of the catalyst. The objectives of this project were to study the fate of titanocene dichloride under hydrotreatment conditions and investigate the mechanisms by which titanocene dichloride affects the catalyst coking and activity. Hydrotreatment of seven model compounds (tetralin, decalin, phenanthrene, methyl-isobutyl-ketone, quinoline, dibenzothiophene, and dibenzofuran) on two commercial catalysts (NiMo/alumina and CoMo/alumina) and a commercial alumina substrate was studied. Titanocene dichloride was either added to the liquid feed or used to impregnate the catalyst. The results of model compound work led us to study the role of free radicals in hydrotreatment of two coal liquids and the effect of titanocene dichloride on free radical formation. Furthermore, the suitability of a gradientless recycle reactor to study reaction kinetics and catalyst coking in a gas-liquid-solid system was evaluated. Overall this project showed the potential of using organometallic compounds in hydropressing to increase conversions and decrease catalyst coking. However, further work is needed to develop this method into a technically feasible process. 101 figs., 87 tabs.

56020 **(DOE/PC/70753—T13) The study of some transition metal complexes as process catalysts: Final report for the period September 1, 1984 to August 31, 1987.** Wilson, B.L. (Texas Southern Univ., Houston (USA). Dept. of Chemistry). 1987. Contract FG22-84PC70753. 36p. NTIS, PC A03. Order Number DE88007329/JAW.

The following are objectives of this project: Preparation and characterization of transition metal complexes with nitrogen, oxygen, and sulfur donor ligands especially the poly(pyrazolyl) borate ligands; Preparation of bimetallic complexes of molybdenum and other metals such as nickel, cobalt, and iron; Determination of the ability of the above complexes to catalytically reduce polycyclic aromatic or heterocyclic compounds; Evaluation of these complexes as a coal liquefaction catalysts; Evaluation of these complexes as desulfurization and denitrogenation catalysts; and Training of students in transition metal complex preparation and characterization and in the evaluation of metal complexes as process catalysts. Results are discussed. 1 fig., 15 tabs.

56021 **(DOE/PC/70812—13) Improved catalysts for coal liquefaction: Final report.** Haynes, H.W. Jr. (Wyoming Univ., Laramie (USA). Dept. of Chemical Engineering). Apr 1988. Contract FG22-84PC70812. 304p. NTIS, PC A14/MF A01. Order Number DE88010547/JAW.

Heterogeneous catalysts prepared from a variety of support materials were tested for activity and activity maintenance while processing coal-derived liquids under high severity conditions (P = 2000 psi, T = 800--825{degree}F, WHSV = 2-3). Conventional alumina supported hydrotreating catalysts were promoted with alkali and alkaline earth metals subjected to similar testing. Initial activity screening was conducted in a batch microautoclave reactor. Activity maintenance was evaluated in a continuous trickle bed reactor with run lengths of up to 500 hours. The feedstocks employed ranged from a hydrogen deficient light creosote oil to a mildly hydrogenated medium creosote oil spiked with ash-free, coal-derived-residuum material. The fresh and used catalysts were characterized structurally and subjected to analysis for carbon on catalyst, metals agglomeration and catalyst acidity. The benchmark commercial catalysts (Amocat 1A and Shell 324M) experienced minimal deactivation early in the run and maintained activity well despite the high severity conditions employed. Several of the laboratory preparations also performed well: most notably a NiMo/titania--alumina catalyst was competitive with the benchmark catalyst in terms of both activity and activity maintenance. A positive correlation was observed between "lined out" activity and pore volume in the 60--200 A diameter range. A correlation was also developed between carbon on catalyst and relative acid density. 116 refs., 100 figs., 94 tabs.

56022 **(DOE/PC/79926—3) Kinetics of coal conversion to soluble products: Quarterly report for the period April 1, 1988 to June 30, 1988.** Yamada, O.; Larsen, J.W. (Lehigh Univ., Bethlehem, PA (USA). Dept. of Chemistry). 27 Sep 1988. Contract FG22-87PC79926. 9p. NTIS, PC A02/MF A01. Order Number DE89002086/JAW.

Objectives of the work are: (1) to reduce to practice a new kinetic technique and data analysis methods providing more insight into coal conversion processes and (2) to use the technique to gain increased understanding of coal conversion under commonly used reaction conditions. Gel permeation chromatography was used to measure the molecular weight distribution of the soluble material resulting from conversion of coal extracts, the insoluble portion of coal and whole coal. Reaction kinetics will be measured. 9 refs.

56023 **(DOE/PC/79937—T3) Serial biological conversion of coal to liquid fuels: [Quarterly report] March 15, 1988--June 15, 1988.** (USDOE Pittsburgh Energy Technology Center, PA). 1988. Contract AC22-87PC79937. 16p. NTIS, PC A03/MF A01. Order Number DE89001387/JAW.

The primary objective of this research project is to isolate and enrich cultures of microorganisms to convert coal into low molecular weight liquid fuels. The approach will be to utilize existing and new cultures to produce and initial liquid product that will subsequently be converted biologically into low molecular weight fuels. Natural inocula and pure cultures will be screened to find the best organisms for the second stage conversion. Serial conversion will be conducted in laboratory reactors to define stoichiometry, yields, reaction rates, and other engineering parameters to demonstrate technical feasibility. This project will also continue the development of a promising bacterial strain that liquefies low or high rank coals without pretreatment. The strain will be identified, mechanisms examined, products quantified and rates for various coals determined. Submerged culture experiments on the solubilization of Arkansas lignite have indicated that 3 days is optimum age for solubility lignite. Culture conditions prior to the 3 days are apparently not sufficient for significant solubilization. Also, new organisms have been isolated from sheep rumen cultures which show excellent ability to degrade solubilized lignite. Work is continuing to identify the products these organisms. 4 figs., 6 refs.

56024 **(DOE/PC/80516—T1) Control of catalyst inactivation with ammonia: Final technical report.** Satterfield, C.N. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Chemical Engineering). [1988]. Contract FG22-85PC80516. 23p. NTIS, PC A03/MF A01. Order Number DE88014208/JAW.

A principal source of catalyst deactivation in hydrotreating is carbonaceous deposit buildup. We have found in this study that catalyst treatment with ammonia can produce considerable rejuvenation, and we have made a systematic study to explore the potential of ammonia treatment. The results can be interpreted in terms of a displacement mechanism. Studies were done in a vertical fixed-bed laboratory-scale reactor packed with a $NiMo/Al_2O_3$ catalyst, that can be operated either as a vapor-phase or trickle bed reactor. Variables studied include: treatment (1) during reaction, (2) in absence of reaction; catalyst deactivation by (1) a hydrotreating reaction, (2) an organonitrogen compound added during reaction, (3) coking with anthracene in absence of H_2; effect of NH_3 on (1) hydrodeoxygenation (of dibenzofuran), (2) hydrogenation (of phenanthrene), and (3) hydrodesulfurization (of dibenzothiophene); and representative variables in ammonia treatment, (1) pressure, (2) temperature, (3) presence of H_2S, (4) presence of a liquid phase. 8 figs., 1 tab.

56025 **(DOE/PETC/TR—88/5) Coal pyrolysis: Literature survey.** Brandes, S.D. (USDOE Pittsburgh Energy Technology Center, PA. Process Science Div.). Mar 1988. 35p. NTIS, PC A03/MF A01. Order Number DE88013963/JAW.

This literature survey has been conducted to form a firm historical basis for continuing research in the field of coal pyrolysis. The literature contains extensive reference to the pyrolysis of coal. This search is not intended to be comprehensive. The emphasis has been placed on elucidating past methods of manipulating the following seven most important variables for coal pyrolysis: (1) time, (2) temperature, (3) pressure, (4) atmosphere, (5) coal rank and type, (6) heating rate, and (7) coal pretreatment and handling. Each of these variables will act as a subsection of the following review. Various methodologies for studying the process of pyrolyzing coal are briefly outlined. Some consideration is given to studies that are concerned mainly with the chemical makeup of coal and how it relates to the chemical makeup of the pyrolysis product. Emphasis has been placed on the most recent literature when the topic has been well covered in previous reviews. 147 refs.

56026 **(PB—88-237722/XAB) User's manual for the Gas Research Institute coal-gasification environmental, health, and safety information system. Topical report.** Meserole, N.P.; Brown, E.W. (Radian Corp., Austin, TX (USA)). Apr 1988. 94p. (RAD—88-218-027-18). NTIS, PC A05/MF A01.
See also PB—87-215984.

GRI has developed an information system to provide GRI managers, member companies, and other participating researchers access to a carefully screened collection of technical information relevant to controlling potential environmental, health, and safety (EH&S) impacts of coal gasification and related technologies, many of which are also used in natural gas production. The information system does not contain data, but rather a brief review of that data or other information, and a rating of its pertinent aspects. All information included has been reviewed, recommended, and rated by an expert in the subject area. The contents are accessible through a computerized system of keyword assignments and bibliographic data for relevant documents, and a manual perusal of reference summary sheets prepared by technical reviewers. The purpose of this manual is to provide users of the GRI Coal Gasification EH&S Information System with an overview of the system, as well as step-by-step instructions for its use.

56027 **(SAND—87-7147) Assessing the economic impact of two-stage liquefaction process improvements.** Gray, D.; Tomlinson, G. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1988. Contract AC04-76DP00789. 78p. NTIS, PC A05/MF A01. Order Number DE89001657/JAW.

The economic impact of demonstrated and projected improvements in two-stage direct coal liquefaction processes is evaluated. The computerized methodology employed estimates the quantity and quality of products from a 30,000 ton/day commercial scale plant, based on input test data. Steam, hydrogen and fuel gas balances are determined. Capital and operating costs are then estimated, and the required selling price of raw liquid products is determined by conventional discounted cash flow (DCF) analysis. Product quality is quantified by computing the cost of upgrading the raw products to motor gasoline. Improvements in two-stage processing since the early demonstration of the Lummus Integrated Two-Stage (ITSL) process in 1980 are shown to reduce the required initial selling price (RISP) of gasoline from coal liquids by about 16 percent. Further process improvements that offer the potential for an additional 15 percent RISP reduction are identified. This report also compares the economics of two-stage processing with earlier studies of the H-Coal, Exxon Donor Solvent and Lummus ITSL processes. The high costs of coal liquids found in these earlier studies are explained and revised costs for these earlier plants using a common financial and technical basis are determined. 17 refs., 12 figs., 28 tabs.

56028 **(SAND—88-2704C) Development of hydrous metal oxide catalysts for direct coal liquefaction.** Stohl, F.V.; Dosch, R.G.; Stephens, H.P. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 14p. (CONF-8810170—1). NTIS, PC A03/MF A01. Order Number DE89000300/JAW.

From DOE direct liquifaction contractor's conference; Pittsburgh, PA, USA (4 Oct 1988).

Improved efficiency in direct coal liquefaction processes could be realized if catalysts with better activity, selectivity and life were available. In previous research supported by the Department of Energy at Sandia National Laboratories, the properties and activities of catalysts prepared via hydrous metal oxide (HMO) ion exchangers were explored and found to have potential for application to a number of reactions associated with the conversion of coal to liquid fuels. The objective of our current work is to develop catalysts, based on hydrous titanium oxide (HTO) ion exchangers, for use in coal liquefaction processing. The ultimate goal of the program is an improved coal liquefaction catalyst produced in quantities that allow for testing in a large-scale process development unit such as the Advanced Coal Liquefaction R & D Facility at Wilsonville, Alabama. 8 refs., 12 figs.

56029 **Method for increasing steam decomposition in a coal gasification process.** Wilson, M.W. US Patent Application 6-028,921. 23 Mar 1987. 12p. NTIS, PC A03/MF A01.

The gasification of coal in the presence of steam and oxygen is significantly enhanced by introducing a thermochemical water-splitting agent such as sulfuric acid, into the gasifier for decomposing the steam to provide additional oxygen and hydrogen usable in the gasification process for the combustion of the coal and enrichment of the gaseous gasification products. The addition of the water-splitting agent into the gasifier also allows for the operation of the reactor at a lower temperature.

0105 By-products

REFER ALSO TO CITATION(S) 56137

0106 Properties

REFER ALSO TO CITATION(S) 56016, 56022, 57488

56030 **(DOE/PC/70006—17) Enthalpy and phase behavior of coal derived liquid mixtures: Final technical report.** Yesavage, V.F.; Kidnay, A.J.; Flanigan, D.A.; Niesen, V.G.; DiGiacinto, S.S.; Joyce, T.P.; Yanaki, J.S. (Colorado School of Mines, Golden (USA). Dept. of Chemical Engineering and Petroleum Refining). 15 Apr 1988. Contract FG22-84PC70006. 172p. NTIS, PC A08/MF A01. Order Number DE88008163/JAW.

Measurements were made in a Freon 11, reference fluid, boil-off calorimeter, and an equilibrium flash vaporization apparatus, experimental systems which had already been developed. Previous studies had indicated that existing data and correlations developed for petroleum fluids are not applicable to coal derived liquids. This was due to the presence of significant concentrations of polar associating heteroatomics in the predominantly aromatic coal liquids. Thus, the ternary system was selected to include an aromatic, a basic nitrogen compound, and a cresol. Measurements were made over a wide range of temperature (200 to 700{degrees}) and pressure (20 to 1500 psia), for the three pure compounds, the three binary mixtures and selected compositions of the ternary. Both enthalpy and phase behavior measurements were made. This set of data will be useful as a standard for fitting and evaluating thermodynamic correlations and equations of state that are applicable to associating fluid mixtures, and thus to coal derived liquids. In addition efforts were and continue to be made at developing equation of state correlations which are applicable to these highly nonideal mixtures. 46 refs., 43 figs., 41 tabs.

56031 **(DOE/PC/70804—T4) Modelling of particle packing and chemistry for CWM rheology: Final report.** Funk, J.E.; Dinger, D.R. (State Univ. of New York, Alfred (USA). Coll. of Ceramics). 31 Mar 1988. Contract FG22-84PC70804. 77p. NTIS, PC A05/MF A01. Order Number DE88015778/JAW.

The two parameters presently hindering the replacement of oil by CWF for energy conversion are: its cost compared with oil, and its technical reliability. Its cost analysis is simple for any poten-

tial manufacturer; the solution to its technical reliability is not. Its technical characterization and consequent production and use reliability have not been adequately addressed. Slurry quality must be predictable based upon measurements of the fundamental physical and chemical properties of each ingredient. It is the purpose of this research to address both these problems. Research was divided into two areas: modelling the yield behavior in Bingham and Casson slurries; effect of dispersants on adsorption/desorption isotherms on coal and oxide powders. 38 refs., 41 figs.

56032 **(DOE/PC/90541—T6) Thermodynamics of heavy coal liquids: Annual report.** Kabadi, V.N. (North Carolina Agricultural and Technical State Univ., Greensboro (USA). Dept. of Chemical Engineering). 1 Oct 1987. Contract FG22-86PC90541. 49p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88012479/JAW.

On September 15, 1986, work was initiated on a program to develop a thermodynamic model for vapor--liquid equilibrium calculations for coal fluids. Some necessary multi-component VLE measurements were also to be carried out as a part of this project. After one year, a thermodynamic model for VLE calculations of defined mixtures of aromatic compounds that occur in coal fluids has been formulated and evaluated using binary VLE data available in the literature. The model uses a characterization of the compounds that can be extended to undefined coal fluids. The model has been successful in predicting binary VLE data. In addition, a flow VLE apparatus has been designed and the equipment necessary is being ordered. 160 refs., 2 figs., 4 tabs.

56033 **(DOE/PC/90913—T7) Biochemistry of bond breaking in coal: Final technical report.** (ARCTECH, Inc., Alexandria, VA (USA)). 22 Aug 1988. Contract FG22-86PC90913. 153p. NTIS, PC A08/MF A01. Order Number DE88015632/JAW.

The goal of this program was to investigate possible biochemical mechanisms by which natural microorganisms solubilize low-rank coals. Specific objectives which were met to attain this goal included: (1) identification of microbes capable of solubilizing low-rank coals; (2) optimization of coal biosolubilization; (3) characterization of the products resulting from microbial coal solubilization; and (4) postulation of biochemical mechanisms involved in coal solubilization using model compound studies to identify bonds which are susceptible to cleavage. Several bacterial and fungal cultures were examined for coal solubilization. A microbial consortium (CP1{plus}2) that was developed at ARCTECH exhibited the best coal solubilization of the cultures tested. This mixture of bacteria and fungi solubilized untreated Leonardite coal as well as pretreated (HNO_3 or H_2O_2) lignites and a Wyodak subbituminous coal. Complex mechanisms of bond breaking are likely involved in coal biosolubilization. The solubilization of coal may be mediated by a combination of biological and non-biological factors. Model compound studies indicated that a variety of bonds thought to be present in coal can potentially be cleaved by the CP1{plus}2 coal solubilizing agents. Solubilization of coals by CP1{plus}2 was most rapid during the initial stages of the reaction. The overall biosolubilization process could not be defined in terms of zero or first order kinetics with respect to product appearance over time. 51 refs., 49 figs., 39 tabs.

56034 **(UCID—20297-88-2) LLNL Granular Solids Flow Project: Quarterly report, April--June 1988.** Walton, O.R. (ed.). (Lawrence Livermore National Lab., CA (USA)). Aug 1988. Contract W-7405-ENG-48. 10p. NTIS, PC A03/MF A01. Order Number DE89001282/JAW.

Research under this project is directed toward obtaining a microstructural understanding of the deformation and flow behavior of granular materials and the rheology of suspensions. Development has been continued of a general method to calculate the hydrodynamic interactions of spheres in suspensions, extending this method to numerically evaluate the effective viscosity of assemblies of freely-moving spheres in a nearly static fluid. During this reporting period the new results include calculations of the viscosity for a suspension of freely-moving spheres, whose structure is not affected by the hydrodynamic forces. Future extensions of this work will include full coupling of the hydrodynamic forces to the particle motions. Numerical modeling of dry granular solids in rapid shearing flows have been continued including simulation of a series of inclined channel flow tests being conducted at UCLA. New calculations with a corrected gap width between the vertical side walls are in substantial agreement with the experiments. Sensitivity of the results to variations in such parameters as the boundary friction coefficient, and number density of particles per unit length during nearly steady flow are being determined. The response of a fractured rock bed to an expanding explosion cavity utilizing a previously developed two-dimensional, polygonal particle mode was simulated. These calculations demonstrated that the dilatent forces acting during initial shearing of a compact assembly of fractured rock can significantly affect the resulting trajectories, and thus, the final crater size and shape. Gaining a more thorough understanding of such effects may lead to improved methods for explosive fragmentation of oil shale and other mineral resources.

0108 Waste Management

REFER ALSO TO CITATION(S) 56527, 56859

56035 **(AI-DOE—13562) Simultaneous removal of NO/sub x/, SO/sub x/, and particulates from flue gas by a moving bed of copper oxide.** Stelman, D.; Ampaya, J.P.; Newcomb, J.C. (Rockwell International Corp., Canoga Park, CA (USA). Rocketdyne Div.). 18 Dec 1987. Contract AC22-83PC60262. 111p. NTIS, PC A06/MF A01. Order Number DE88004838/JAW.

This report describes a single-stage, continuous process for simultaneously removing 90% of the NO/sub x/, 90% of the SO/sub x/, and 99.9% of the particulate material from flue gas from coal-fired combustion sources. The process uses a novel contactor/filter with a moving-bed of copper oxide absorber-catalyst. The contactor/filter was tested at 400{degree}C for NO/sub x//SO/sub x/ removal, and at room temperature for particule removal. The inlet concentration levels were 3000 ppM SO_2, 500 ppM NO, and 11.5 g/Nm^3 (5 gr/scf) of fly ash, which correspond to combustion of Illinois No. 6 coal with 20% excess air. The system demonstrated 90% NO/sub x/, 90% SO/sub x/, and 99.9% particulate removal with a Cu/S ratio of 1.02, NH_3/NO ratio of 0.92, gas-solid contact time of 0.52 seconds, catalyst utilization of 88%, and a total pressure drop of less than 1.5 kPa (6 in. of water). These results met the objectives of the program. 18 refs., 34 figs., 5 tabs.

56036 **(EPRI-CS—6044) Advanced SO_2 control by-product utilization laboratory evaluation: Final report.** (Electric Power Research Inst., Palo Alto, CA (USA); ICF Northwest, Richland, WA (USA)). Sep 1988. 344p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89000251/JAW.

This report presents the results of an investigation into the utilization potential of by-products from the following advanced SO_2 control processes: Atmospheric Fluidized Bed Combustion; Calcium Spray Drying; Limestone Furnace Injection; Sodium Sorbent Injection; and Calcium Sorbent Injection. Utilization applications identified as potentially feasible (from both technical and market perspectives) in the preliminary investigation (EPRI CS-5269) were evaluated through small-scale laboratory testing. The applications considered were primarily low to medium technology process and medium to high volume use applications. The laboratory test results were evaluated in concert with by-product physical, chemical and extract characteristics (developed during EPRI Research Project 2708-1) and a market assessment. Then, an economic evaluation was performed for each utilization application based upon a typical or hypothetical by-product marketing situation in which an advanced SO_2 control by-product could be substituted for a competing material on a local project or in a local product. Finally, based on the major factors considered in this project (laboratory characterization, technical feasibility evaluation, and economic and market assessments), the utilization potential for each application considered was rated as high, medium or low, and future research needs were identified. The following utilization applications were found to have a high potential for the majority of the calcium-based advanced SO_2 control by-products: road base, soil and sludge stabilization and grout applications. 76 refs., 18 figs., 70 tabs.

56037 (NEI-FI—42) Finnish-Soviet cooperation in flue gas desulphurisation technique. Rantanen, K. (Cleanair Oy, Kaarina (Finland)). 1987. 60p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754869/JAW.

Research and development in the USSR in the area of flue gas desulphurization and the related technology were investigated. At the same time, contacts with research institutes and other organizations in the USSR were established. The possibility of Finnish-Soviet co-operation was discussed. Promising areas for co-operation are, for example, the reduction of the consumption of sorbents when limestone is used to bind sulphur, the simultaneous removal of sulphur and nitrogen oxides by means of ozone, the chemical irradiation of flue gas, and the desulphurization of coal gas during the gasification of solid fuels. Further co-operation consists of a more detailed study of the methods mentioned above. Opportunities for co-operation in production and marketing are also being investigated.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 56012, 56015, 56035, 56061, 56064, 56065, 56527, 56530

56038 (CEGB-OED-STM—87-00014-M) Long term air pollution surveys around power stations. Martin, A.; Barber, F.R. (Central Electricity Generating Board, Ratcliffe-on-Soar (UK). Operational Engineering Div.). Apr 1987. 26p. Central Electricity Generating Board, Ratcliffe-on-Soar (United Kingdom). Operational Engineering Division, Midlands Area, Scientific and Technical Branch.

This report discusses the seasonal patterns in sulphur dioxide and dustfall data collected over the past 20 years in the vicinities of the Radcliffe and Cottam power stations. In addition, winter and summer dustfall trends over the past 3 years are presented for sites in the vicinity of the Drakelow power station.

56039 (CRIEPI-U—87015) Effect of simulated acid rain on the growth and yield of soybean plants grown in pots. Kohno, Y. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). 1987. Vp. (In Japanese). Central Research Institute of Electric Power Industry, Tokyo, Japan.

Soybean plants (Glycine max) growth in plastic pots were exposed to simulated acid rain to assess effects of acid rain on crop yields. Simulated acid rain was composed of major ion components: sulfate, nitrate and chloride, whose concentration ratio on the weight basis was 2:1:1 equivalent to an average of ambient rain samples in Japan. Frequency of rain event was twice a week during a growing season, duration of event was 1 hour and amount of precipitation in each event was 2.2 or 5.0 mm. When simulated acid rain was below pH 3.0, visible symptoms such as small pale brown necrotic spots were developed in the younger trifoliate leaves. However, any visible symptoms were not observed over pH 3.0 Tissue dry weight, trifoliate leaf area and dry seed yield were not significantly affected by exposure of simulated acid rain over pH 3.0. Leaf areal growth, total dry weight and dry seed yield of soybean plants exposed to simulated acid rain at pH 2.0 during growing season, were significantly reduced. Yield reduction in one of the experiments was due to the decreased total pod numbers per plant; that in the second experiment was due to decreased seed mass per pod.

56040 (EUR—10832) Physico-chemical behaviour of atmospheric pollutants. Angeletti, G.; Restelli, G. (eds.). (Reidel (D.) Publishing Co., Dordrecht (Netherlands)). 1987. 822p. (CONF-8609195—). Reidel (D.) Publishing Co., Dordrecht, Nederlands.

From 4. European symposium on the physico-chemical behaviour of atmospheric pollutants; Stresa, Italy (23 Sep 1986).

This volume contains papers presented at a symposium on air pollutants. The aim of the symposium was to view current studies and technical progress achieved in the various sectors of the Concerted Action COST 611 which is included in the R & D Programme on Environmental Research of the Commission of the European Communities. Papers are organised into 5 sections which include the following topics: analysis of pollutants; chemical and photochemical reactions; mechanisms and rates; aerosol characterization and particle formation; pollutant cycles; transport and modelling. From these papers, it is clear that the aspects related to the physico-chemistry of acid deposition and formation of photochemical oxidants in the troposphere have received particular attention.

56041 (IEACR—11) Emission standards for coal-fired plants. Vernon, J.L. (IEA Coal Research, London (UK)). Aug 1988. 52p. IEA Coal Research, London (United Kingdom).

The report provides information on current and proposed air pollutant emission standards applicable to coal combustion plants. Three major pollutants are covered: sulphur dioxide (SO_2), nitrogen oxides (NO/sub x/), and particulates. All 14 IEA Coal Research countries and some others are included. Principally national standards are described but significant legislation at a state, provincial or regional level is included. General legislative approaches are described. The report is organised on a country basis with international agreements and standards described in a separate section. For each country a text section describes the general background to air pollution control policy then tables list emission standards currently in force and those which are the subject of firm proposals.

56042 (WMO-TD—225) Developing policies for responding to climatic change. Jaeger, J. (comp.). (World Meteorological Organization, Geneva (Switzerland)). Apr 1988. 59p. World Meterological Organization, Geneva Switzerland.

In the autumn of 1987, two workshops were held at Villach in Austria and Bellagio in Italy to discuss the ways in which changes in climate and sea level resulting from increases of gas concentrations in the atmosphere could affect various regions of the Earth in the next century. The technical, financial and institutional options for limiting or adapting to climatic changes were discussed; the material presented was used as basis for an analysis of possible policy steps which might be implemented in the near term and what institutional arrangements would be needed to achieve them. The report includes possible scenarios for changes of climate and sea-level; and the effects of climatic change on regions in the high latitudes, middle latitudes, humid tropics, semi-arid tropics and coastal zones.

0110 Reserves And Exploration

56043 Are alternative coalification paths possible for terrestrial coal. Kopp, O.C.; Harris, L.A. (Univ. of Tennessee, Knoxville (USA)). *Geology;* **16**: No. 9, 844-847(Sep 1988).

It is generally assumed that the coalification of terrestrial kerogens proceeds along an orderly, progressive path from lignitic to anthracitic coal. However, when information concerning the volatile compounds present in coal (the average volatilization rate [AVR] determined by thermogravimetry) is compared with the hydrogen to carbon (H/C) ratio, some subbituminous coal samples that have relatively low H/C ratios ($\leqq 0.75$) appear to contain insufficient amounts of hydrogen to be transformed into high-volatile bituminous coal. These samples also have relatively high oxygen to carbon (O/C) ratios (> 0.14). The positions of these samples on an AVR vs. H/C plot suggests that their transformation to the high-volatile bituminous rank would not be possible unless hydrogen in some form were added from an external source. The results suggest that all terrestrial coal may not necessarily pass through all preceding ranks. Alternative coalification paths may be possible as a result of differences in the composition of precursor plant material, the conditions prevalent during peatification, and the temperature, pressure, and confining-pressure conditions during coalification.

0120 Mining

REFER ALSO TO CITATION(S) 56085

56044 (ACIRL-PR—88-2) Correlation of bucket wheel excavator performance with geotechnical properties of overburden at Goonyella Mine Central Queensland. O'Regan, G.J.; Hatherly, P.; Irwin, P.; Davies, A.L. (Australian Coal Industry Research Labs. Ltd., North Ryde). Jun 1988. 76p. Australian Coal Industry Research Labs. Ltd., North Ryde.

The bucket wheel excavator (BWE) at Goonyella Mine operates in overburden ranging from soil through to hard unweathered Permian sandstone. Comprehensive geotechnical investigations are required to assess the BWE diggability in such variable overburden conditions. The investigation procedure incorporates refraction seismic, wireline sonic logging, and limited core drilling and materials testing. This report presents results of a study where bucket wheel performance was comprehensively monitored and correlated with geotechnical properties of the excavated overburden. 40 refs., 38 figs., 13 tabs.

56045 (EUR—11416-FR) Adaptation of a tunnelling machine to the conditions proper to the Campine with regard to boring. Philippron, P.; Bie, J. de; Duyse, H. van; Boxho, J. (Commission of the European Communities, Luxembourg). 1988. 134p. (In French). Commission of the European Communities, Luxembourg.

In order to increase the rate of advance during tunneling, the Bouygues tunneling machine was modified to allow reinforced concrete rings to be placed at less than 1.4 m from the working face. The tunneling machine was anchored to the panels. The panels chosen were 30 cms thick reinforced with rods and connecting clamps at 40 mm intervals. Various packings were tested for stowing behind the panels. Preliminary tests took place in April 1984; by June, a tunnel of 2116 m had been bored. Problems were caused by the presence of coal seams in the roof, and by water inrushes from faults; a mining method was evolved which allowed a collapsing cavity to develop, calm and then be filled with a cement-lime filler. The drifts bored proved to be remarkably stable, indicating the superiority of the 30 cm thick panels over conventional 20 cm ones. After two years, a theoretical model of costs could be set up and adaptation curves deduced.

56046 (IOM-TM—88-03) Ergonomic guidelines for control room software used with automated vertical guidance of shearers. Talbot, C.F.; Collier, S.G.; Graveling, R.A. (Institute of Occupational Medicine, Edinburgh (UK)). Jan 1988. 183p. Institute of Occupational Medicine, Edinburgh, United Kingdom.

MIDAS (Machine Information Display and Automation System), in addition to its vertical guidance function, continuously transmits steering data and information from other sensors to the surface permitting the remote monitoring of the status and progress of the machine on the coal face. This study was concerned with providing ergonomic guidelines for the design of software being developed for the surface monitoring of this information. In particular, it addressed factors such as the interactive dialogue and the design of the displays used by the system. Initially, general guidelines were derived following an examination of the existing MIDAS surface display system to determine those elements of software design which were relevant to the system and its planned development and a survey of the literature on ergonomic factors associated with computer systems. In order to tailor the system to specific needs a series of structured interviews with a variety of HQ, Area and Colliery staff was conducted, which identified a number of principle tasks for which the MIDAS system was used in a consistent manner, including monitoring current shearer performance and face management. This information was then used in conjunction with the design guidelines to identify problems and to produce specific ergonomic recommendations for their solution.

56047 (NAGRA-NTB—87-31) Crosshole investigations - physical properties of core samples from boreholes F1 and F2. Magnusson, K.A.; Carlsten, S.; Olsson, O. (Sveriges Geologiska Undersoekning, Stockholm). (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Jun 1987. 68p., Nagra, CH-5401 Baden, Switzerland.

The geology and physical properties has been studied of roughly 100 core samples from the boreholes F1 and F2 drilled at the Crosshole site, located at the 360 m level in the Stripa mine. The granitic rock has been divided into two classes: fracture zones (also called major units) and a rock mass which is relatively undeformed. Samles from the major units have lower resistivity, higher porosity and dielectric constant than the samples from the less deformed rock mass. The electrical properties of the core samples have been measured over a frequency interval ranging from 1 Hz to 70 MHz. The conductivity of the samples increases with frequency, approximately with the frequency raised to the power 0.38. The dielectric constant decreases with frequency but is essentially constant above 3 MHz. These results show that the Hanai-Bruggeman equation can be used to describe the electrical bulk properties of the Stripa granite. The electrical conductivity of the samples is well correlated to the water content of the samples. The granite has a small content of electrically conductive minerals which could influence the electrical bulk properties. (author) 14 refs., 19 figs., 4 tabs.

56048 (PB—88-229638/XAB) Cost comparison of gob hole and cross-measure borehole systems to control methane in gobs. Report of investigations/1988. Baker, E.C.; Garcia, F.; Cervik, J. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1985. 30p. (BM-RI—9151). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600349.

The capital investment and operating costs of two methane-control systems used during longwall mining operations are compared in the Bureau of Mines report. Costs are given for a surface gob hole drainage system and an underground cross-measure borehole drainage system to control methane gas in gobs in four coal mining areas-central Pennsylvania, northern West Virginia, southern Virginia, and northern Alabama. Present-worth analysis is used to determine the more cost-effective alternative in each location.

56049 (PB—88-229695/XAB) In-situ horizontal-stress determinations in the Yampa Coalfield, Northwestern Colorado. Report of investigations/1988. Bickel, D.L.; Donato, D.A. (Bureau of Mines, Denver, CO (USA). Denver Research Center). 1988. 50p. (BM-RI—9149). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600291.

This report presents a Bureau of Mines study intended to determine if horizontal-stress trends exist and if the stresses can be projected for improved mine design in a selected coal field. The horizontal stresses were determined in three mines in the Yampa Coalfield and one mine in the adjacent Danforth Hills Coalfield of northwestern Colorado. Stresses were determined from stress-relief measurements using a three-component borehole deformation gauge and overcoring techniques developed by the Bureau. A least-squares method of calculating the average rock stress components in the horizontal plane was performed. Physical properties of the rock from the test sites are also included.

56050 (PB—88-229810/XAB) Development of rapid-setting inorganic grouts. Report of Investigations/1987. Fraley, J.E.; Bevan, J.E. (Bureau of Mines, Spokane, WA (USA). Spokane Research Center). Feb 1987. 27p. (BM-RI—9124). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600144.

The preliminary results are presented of tests of an inexpensive grout for full-column support of roof bolts. Various inorganic grouts were tested in both cartridge and slurry form. Tests were also performed on methods of water packaging and on the effect of fillers on the grout strength. Results showed that some grouts had poor early strength and exceptional mid- to long-term strength. Laboratory tests have shown that rapid-setting inorganic grout could be an economical replacement for resin bolts if the short-term

strength could be increased. Further development to improve its early strength would need to be tested in the laboratory and underground to prove its potential for the mining industry.

56051 **(PB—88-229844/XAB) In-situ comparison of radial and point-attack bits. Report of Investigations/1987.** Sundae, L.S.; Myren, T.A. (Bureau of Mines, Twin Cities, MN (USA). Twin Cities Research Center). Feb 1987. 22p. (BM-RI—9127). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600179.

Tests were conducted to compare the cutting forces required by radial and point-attack bits when making similar cuts. Three radial and four point-attack bits were tested in two coal mines using an inseam tester to measure coal-cutting forces in situ. Tests were also conducted to investigate the effects of weathering and cleating. The test results show that in each case, at a specific clearance angle, the radial bits required less tangential and much less normal force than the point-attack bits. The resultant of the cutting forces for some types of cut was 50% less at mine 1 for radial cuts compared to cuts with the best point-attack bit, and 40% less at mine 2. Cutting coal perpendicular to the cleat planes required less cutting and normal force than the same type of cuts parallel to the cleat planes.

56052 **(PB—88-230172/XAB) Avoiding anchorage problems with resin-grouted roof bolts. Report of Investigations/1987.** Pettibone, H.C. (Bureau of Mines, Spokane, WA (USA). Spokane Research Center). 1987. 35p. (BM-RI—9129). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600102.

Mine-safety personnel reported occurrences of excessive glove-fingering and other problems with resin-grouted roof bolt installations. To study these problems a test plan was designed to (1) obtain baseline information on several resin cartridges and (2) investigate the variables involved in the installation of a resin bolt. Three brands of resin representative of those used in the industry in January 1983 were selected for cartridge evaluation. The installation variables selected for study were the method of installation, the hole depth, and the hole annulus. These variables were studied by installing a series of bolts in concrete blocks using different values for each variable. Results show that overspinning the resin may cause problems, but they can be avoided by using the spin times recommended by the manufacturers.

56053 **(PB—88-230180/XAB) Time-dependent behavior of coal-measure rocks: adsorption rate and strength degradation. Report of investigations/1987.** Tandanand, S. (Bureau of Mines, Twin Cities, MN (USA). Twin Cities Research Center). 1987. 26p. (BM-RI—9131). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600193.

The time-dependent behavior of coal-measure rocks was investigated for implementation in stability analysis and safety evaluation of in-mine rock structures. The initial study focused on moisture adsorption rate and strength degradation of shales in Pennsylvanian coal-bearing strata in the Illinois Basin. A reaction of clay minerals in Illinois shales with atmospheric water vapor was hypothesized as the adsorption and strength degradation mechanism. Part of the energy exchange between shales and the environment was attributed to a free energy controlled by pore pressure of the rock and partial pressure in the environment. The relationships between adsorption versus time and strength degradation versus moisture content were derived and correlated with the experimental data. Partial saturation at various levels of relative humidity occurs within approximately 2 weeks at room temperature. The strength of shales tested decreases linearly with increasing moisture content. When the moisture exceeds 7 pct of the dry weight, these Illinois shales become unstable. To this end, the moisture content is a good predictor of rock strength for shales.

56054 **(PB—88-230222/XAB) Reduction in frictional ignition due to conical coal-cutting bits. Report of Investigations/1987.** Cheng, L.; Furno, A.L.; Courtney, W.G. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 23 Apr 1987. 17p. (BM-RI—9134). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600265.

The Bureau of Mines conducted laboratory tests to investigate the ease of frictional ignition with frozen (nonrotating) conical bits cutting into sandstone. The number of strikes with a new bit to obtain ignition of a combustible methane-air environment was measured. Tests were made with bits tipped with both tungsten carbide and steel at several bit attack angles (angle between bit axis and sandstone surface) and initial tip angles (included angle at the tip of the new bit). Carbide-tipped bits required more strikes for ignition than steel-tipped bits by a factor of 7 to 10.

56055 **(PB—88-230230/XAB) Linear load-transfer mechanics of fully grouted roof bolts. Report of Investigations/1987.** Serbousek, M.O.; Signer, S.P. (Bureau of Mines, Spokane, WA (USA). Spokane Research Center). 1987. 24p. (BM-RI—9135). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600115.

The load-transfer mechanics of fully grouted roof bolts in coal mines were investigated in laboratory and analytical studies. The purpose of the Bureau of Mines research is to increase understanding and better interpret data from routine field-pull tests and to develop a numerical model of a grouted bolt that can be used in a global computer model of a mine roof. Analytical studies using closed-form solutions and finite-element techniques were compared to experimental results.

56056 **(PB—88-230800/XAB) Measurement of incombustible content of coal mine dust samples. Report of Investigations/1988.** Greninger, N.; Courtney, W.; Lang, H. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 19 Feb 1987. 21p. (BM-RI—9155). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600181.

The Bureau of Mines conducted a laboratory study of the measurement of the water and rock dust (RD) contents of synthetic mine-type coal dust (CD) mixtures using a commercial unit for measuring water content and several prototype radiometric units for measuring the RD content. The RD content ranged from 50 to 100 wt pct and the added water (AW) ranged from 0 to 15 wt pct.

56057 **(PB—88-230966/XAB) Effect of load rate on wood-crib behavior. Report of Investigations/1988.** Barczak, T.M.; Schwemmer, D.E. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). Jul 1987. 18p. (BM-RI—9161). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600362.

The effect of load rate on the load-carrying capabilities of wood cribs is investigated. The modulus of deformation (stiffness) of wood-crib blocks has been shown to increase with increases in rates of load application, causing larger load reactions for increases in convergence rates. Wood cribs tested in the laboratory will react to larger loads than the same cribs would react underground for the same displacement. Tests conducted in the Bureau's mine roof simulator on green wood crib blocks indicate that the increase in stiffness for increasing load rates diminishes at displacement rates beyond 0.1 in/min, making crib load nearly independent of load rate for rates faster than 0.1 in/min. Seasoned wood specimens were not as consistent in load-rate dependency. Some possible explanations of observed load-rate behavior on wood crib specimens are also postulated in the paper.

56058 **(PB—88-231246/XAB) Critical-load studies of a shield support. Report of investigations/1987.** Barczak, T.M.; Schwemmer, D.E. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1987. 22p. (BM-RI—9141). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600280.

One of the primary goals of Bureau of Mines research is to reduce the cost of coal mining by improving the efficiency of longwall supports. One method of achieving the goal is the optimization of stress distribution within the support structure, resulting in a lower overall weight, more fully stressed shield. However, before stress optimization can be initiated, load conditions must be defined that cause maximum stress in the various support components. A finite-element model of a longwall shield was used to identify these critical load conditions. These load conditions were then evaluated

in the Bureau's mine roof simulator by instrumentation of a longwall shield and measurement of strains in each of the shield components.

56059 **(PB—88-231253/XAB) Prediction of surface deformations over longwall panels in the northern Appalachian coalfield. Report of Investigations/1987.** Adamek, V.; Jeran, P.W.; Trevits, M.A. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1987. 22p. (BM-RI—9142). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600281.

A subsidence prediction methodology suitable to the mining and geologic conditions in the Northern Appalachian Coal Region was developed. The substance of this method is the separation of the effects of lithology by introducing a correlation between hypothetically homogeneous overburden and existing lithologic conditions, while providing for different mining conditions such as underground geometry and overburden thickness. The effects of lithology are expressed in the form of a variable subsidence coefficient within the subsidence trough. The subsidence coefficient is considered a constant for other predictive methods. Field data from 16 test sites at 11 longwall panel studies were used in the analysis. For each panel, the characteristics of the variability of the subsidence coefficient were defined.

56060 **(PB—88-231261/XAB) Protective structures for low-coal shuttle-car operator. Report of Investigations/1987.** Bartels, J.R.; Kwitowski, A.J.; Mayercheck, W.D. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1987. 29p. (BM-RI—9143). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600183.

The report discusses the Bureau of Mines efforts to develop partial protective structures for operators of low-coal shuttle cars. In coal seams 48-in. high or less, full-coverage canopies are generally difficult or may be impossible to implement on high-speed face equipment owing to the restrictions they impose on the operator's vision and comfort. Three possible limited-coverage design scenarios (roll bars, sliding canopies, and flip-top canopies) were designed, fabricated, and evaluated for low-coal shuttle cars.

56061 **(PB—88-231576/XAB) Diamond Chuitna Coal Project. Draft environmental impact statement.** (Environmental Protection Agency, Seattle, WA (USA)). Jun 1988. 548p. (EPA—910/9-87/172). NTIS, PC A23/MF A01.

This Draft Environmental Impact Statement for the Diamond Chuitna Coal Project was prepared pursuant to the National Environmental Policy Act. The actions to be considered are the approvals of permits for the proposed project located on the west side of Cook Inlet in southcentral Alaska. The project would consist of a surface coal mine, haul road, a method of transporting coal to a port facility on Cook Inlet, dock facilities, and other ancillary facilities. Three action alternatives and a No Action Alternative are discussed in detail. The impacts of the proposed project are considered in terms of vegetation, fish, wildlife, wetlands, water quality and hydrology, physical and chemical oceanography, air quality, visual resources, cultural resources, subsistence, socioeconomics, recreation, technical feasibility, and future uses of facilities.

56062 **(PB—88-231675/XAB) Corrosion of friction rock stabilizer steels in underground-coal-mine waters. Information circular/1987.** Jolly, A.F.; Neumeier, L.A. (Bureau of Mines, Rolla, MO (USA). Rolla Research Center). 1987. 21p. (BM-IC—9159). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600138.

In an effort to better predict the useful service life of friction rock-stabilizer mine roof bolts in coal mine environments, the Bureau of Mines has evaluated the corrosion resistance of stabilizer steels in air-satuated and deaerated waters from seven Eastern and Midwestern underground coal mines. Accelerated electrochemical corrosion tests were used to estimate corrosion tests were used to estimate corrosion rates for the two high-strength, low-alloy (HSLA) steels used to fabricate Split Set stabilizera and for galvanized steel. Long-term static-immersion weight-loss tests were also conducted with the HSLA steels.

56063 **(PB—88-231709/XAB) Suggested minimum-performance specifications for underground-coal-mine environmental monitoring systems. Information Circular/1987.** Welsh, J.H.; Cohen, A.F.; Chilton, J.E. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1987. 46p. (BM-IC—9157). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600230.

The Bureau of Mines report presents guidelines to be considered in the design, installation, and operation of environmental mine-monitoring systems in underground coal mines so as to enhance safety in the U.S. mining industry. A review of the current status of mine monitoring in the United States also is provided.

56064 **(PB—88-231915/XAB) Test apparatus for measuring sound power levels of drills. Information Circular/1987.** Aljoe, W.W.; Stein, R.R.; Bartholomae, R.C. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1987. 42p. (BM-IC—9166). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600273.

The Bureau of Mines report describes in detail the design and operation of a test apparatus for measuring the sound power levels of drills used by the mining industry. The two major components of the test apparatus are a computer-controlled automated drill test fixture (ADTF) and a 45,000 cubic ft. reverberation chamber that houses the ADTF. Design specifications and performance capabilities of the ADTF and the reverberation room are given. Initial test results for three types of drills - a pneumatic percussion drill, a hydraulic percussion drill, and a pneumatic rotary drill - are given to illustrate the types of experiments that can be conducted with the test apparatus.

56065 **(PB—88-231931/XAB) Coal combustion in a ventilated tunnel. Information Circular/1987.** Egan, M.R. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 28 Apr 1987. 20p. (BM-IC—9169). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600251.

The Bureau of Mines experimentally burned Pittsburgh Seam coal and other combustible materials found in mines in order to obtain a better knowledge of their emission products. These experiments were coducted in the Bureau's intermediate-scale fire tunnel, which simulates environmental conditions in underground mines. Smoke characteristics, gas concentrations, mass loss, and ventilation were measured. From these values, heat-release rates, particle sizes, obscuration rates, combustion yields, and production constants were calculated. The information was sought as part of a comprehensive study of combustible materials that will ultimately advance the design of more efficient fire detection and suppression systems. The coal combustion measurements presented in the report, together with previous analyses of wood and transformer fluid fires, form a data base by which future studies of other mine combustibles can be compared.

56066 **(PB—88-232061/XAB) Geologic conditions affecting coal-mine ground control in the western United States, 1988. Information Circular/1988.** Sames, G.P.; Laird, R.B. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). May 1987. 37p. (BM-IC—9172). NTIS, PC A03/MF A01.

See also PB—86-217171; Library of Congress catalog card no. 87-600353.

The Bureau of Mines recently initiated a study of geologic features that contribute to roof instability in western U.S. underground coal mines to provide information for use in ground-control planning and safety-hazard reduction in that region. Although the conditions found do not differ in kind from hazardous geologic conditions in the Eastern United States, they do differ in intensity of occurrence and relative importance. Three depositional features dominate where unstable roof occurs in western underground coal mines: paleochannel deposits, crevasse splay deposits, and flood basin deposits. Three structural features identified as hazardous, but not so widespread or common as the depositional hazards, are faulting, jointing, and igneous intrusions. The survey establishes a foundation for future studies aimed at reducing and preventing ground control accidents in western coal mines.

56067 **(PB—88-232087/XAB) Surface testing and evaluation of the hopper-feeder-bolter. Information Circular/1988.** Evans, R.J.; Mayercheck, W.D.; Saliunas, J.L. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1988. 46p. (BM-IC—9171). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600300.

The Hopper-Feeder-Bolter (HFB) is a prototype multifunctional machine designed to improve productivity by minimizing continuous-miner place changes. It is designed primarily to work beside a two-pass continuous miner, bolting on one side and then place changing to bolt the other side while simultaneously providing a surge car and lump breaker located directly behind the continuous miner. Surface testing was conducted at the Bureau of Mines Mine Equipment Test Facility to evaluate overall system performance and reliability. Tests were conducted to evaluate place changing, tramming, lump breaking, roof bolting, drawbar pull, coveying, temporary roof-support capacity, lighting, and noise. Surface-test results indicate the HFB is ready to be tested and evaluated underground in a production mode.

56068 **(PB—88-232111/XAB) Analysis of cutter roof failure induced by clastic dikes in an underground coal mine. Report of Investigations/1987 (Final).** Bauer, E.R.; Hill, J.L. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 8 Dec 1986. 30p. (BM-RI—9117). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 600149.

Cutter roof failure, a ground-control problem that frequently results in massive roof failure, is common in coal mines of the Northern Appalachian Coal Basin, causing delays in production and posing a safety hazard to mine personnel. The Bureau of Mines is conducting research on the causes of cutter roof failure to gain a basis from which to predict and prevent its occurrence, and to support such roof when failure occurs or is imminent. Research revealed a correlation between the presence of clastic dikes and formation of cutter roof failure. Staggering of crosscuts prevented the extension of cutters and deterred the occurrence of large falls extending over several break-throughs. In addition, trusses and cribbing were effective in stabilizing clastic dikes and inhibiting the development of cutter roof failure when employed immediately or shortly after mining.

56069 **(PB—88-232160/XAB) Borehole (slurry) mining of coal, uraniferous sandstone, oil sands, and phosphate ore. Report of Investigations/1987.** Savanick, G.A. (Bureau of Mines, Twin Cities, MN (USA). Twin Cities Research Center). 1987. 46p. (BM-RI—9101). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 86-600222.

Advances in the art of borehole (slurry) mining and the design of a prototype borehole-mining tool (BMT) developed by the Bureau of Mines are presented along with production data, reclamation data, and an application of the BMT to the mining of coal, uraniferous sandstone, oil sands, and phosphate ore. The BMT was first used near Wilkeson, WA, where steeply pitching metallurgical was mined at 8 st/h from a depth of 25 to 75 ft. Next, 940 st of uraniferous sandstone was mine at 8 st/h from a depth of 75 to 100 ft in Natrona County, WY. One thousand short tons of oil sands was mined in Kern County, CA. at the rate of 14 st/h from a depth of 110 to 150 ft in 1979. Most recently, 1,700 st of phosphate ore was produced at 25 st/h from deep (230- to 250-ft) deposits in St. Johns County, FL. Progressive improvements were made in the borehole mining technique. These include the use of the hydrostatic head of a water-filled borehole for roof support and the development of methods to survey and backfill mined-out cavities.

56070 **(PB—88-232210/XAB) Assessment and determination of illumination needs for operators of mobile surface-mining equipment. Information Circular/1987.** Mayton, A.G. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). Nov 1986. 44p. (BM-IC—9153). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600143.

The Bureau of Mines conducted one of the most-extensive studies on surface mine illumination to date to assess the illumination needs of mobile surface-mining machinery with respect to the visual tasks required of machinery operators. Field investigations were performed at 22 surface-mining operations (coal and metal-nonmetal) within several mining regions of the United States. Visibility and illumination were measured for 159 visual tasks performed by equipment operators on or near 57 surface-mining machines, including draglines, shovels, blasthole drills, bulldozers, loaders, haul trucks, graders, scrapers, and several service-type vehicles. The report shows that illumination and/or visibility could be improved for various visual tasks and makes recommendations for these improvements. Moreover, the report describes the various equipment studied, gives details of the instruments and measuring techniques used, and presents equations to calculate the luminance and illuminance levels suggested for performing mining tasks.

56071 **(PB—88-232475/XAB) Mechanical behavior of coal-measure rocks: elastic-inelastic behavior. Report of Investigations/1987.** Tandanand, S.; Thill, R.E. (Bureau of Mines, Twin Cities, MN (USA). Twin Cities Research Center). 1987. 34p. (BM-RI—9109). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 86-607908.

A safe working environment can be provided for underground coal miners through implementing new ground-control technology. To devise a practical method for stability design of underground rock structures in coal mines, the Bureau of Mines has examined the time-independent behavior of coal-measure rocks in uniaxial and triaxial compression tests. These rocks exhibit work-hardening before failure. Their stress-strain relationship can be expressed by a hyperbolic equation similar to that for soils. The behavior of rocks at failure can be regarded as the limit of work-hardening. To simplify the stability design for temporary rock structures, rock behavior may be idealized as perfectly plastic for stability analyses of roof, ribs, and floor in underground coal mines, although such idealization does not strictly represent the real inelastic behavior of rocks.

56072 **(PB—88-232525/XAB) Photographic method for determining mineral reflectances in underground mines. Report of Investigations/1987.** Mayton, A.G. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). Jun 1986. 21p. (BM-RI—9107). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600077.

A study was conducted to (1) determine from laboratory tests the feasibility of a photographic method for determining reflectances that may be applied to measuring in-mine mineral reflectances, and (2) formulate a procedure for collecting and analyzing the data. The method uses a 35-mm camera with automatic flash and a gray-scale reflectance standard to collect on film reflectivity data in underground mineral mines. After the film is processed, the data on the photographic prints are analyzed in the laboratory with a photometer. Test results show that the photographic method can provide values of reflectance within + or - 5 pct of full scale (full scale = 100 pct). The method's usefulness for determining reflectivity values within similar limits of absolute percent error at the lower end of the scale, however, has not been completely resolved by the study and consequently warrants further investigation.

56073 **(PB—88-232939/XAB) Performance evaluation of two light-scattering dust monitors. Information Circular/1987.** Vinson, R.P.; Williams, K.L. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1987. 20p. (BM-IC—9162). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600188.

The Bureau of Mines evaluated two real-time light-scattering just monitors by measuring their response to Pittsburgh Seam coal dust and Arizona road dust (ARD). Both monitors-the PDS-1, a personal dust sensor, and the PCD-1, a digital dust indicator-are made in Japan by Sibote Scientific Ltd. Tests were conducted inside a laboratory aerosol chamber designed to maintain a uniform spatial distribution of the test dust. PDD-1 and PCD-1 measurements of concentrations for each test dust were averaged over 4-h test periods and compared with simultaneous gravimetric measurements. Both dust monitors responded linearly with mass concentration with both coal dust and ARD. However, the linear response of the PDS-1 differed from that of the PCD-1 for both dusts.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 56078, 56122

0140 Combustion

REFER ALSO TO CITATION(S) 56012, 56080, 56180, 56181, 56521, 56525

56074 **(DOE/MC/21395—2298-Vol.2) Gas turbine component screening program: Volume 2, Evaluation of long-term deposition effects: Final report.** Kimura, S.G.; Spiro, C.L. (General Electric Co., Schenectady, NY (USA)). Mar 1987. Contract AC21-84MC21395. 302p. NTIS, PC A14/MF A01; 1; GPO Dep. Order Number DE87006498/JAW.

The objectives of the "Gas Turbine Component Screening Program" were twofold. The first objective was to experimentally develop a heavy-duty gas turbine combustion system capable of burning coal water slurry (CWS) either alone or with a pilot fuel at sufficiently high combustion efficiency to enable it to be used for subsequent ash deposition tests. This combustion system would also provide a basis for the future development of a system capable of burning CWS without the use of a pilot fuel. The second objective of the program was to evaluate the long-term ash deposition effects caused by burning CWS and to evaluate operating approaches to control the deposition. These deposition tests were done using an aircraft derivative turbine simulator and a modified aircraft (J-79) combustor.

56075 **(DOE/PC/80528—T10) Group combustion of coal particles: Final report, September 15, 1985-April 30, 1988.** Annamalai, K.; Ryan, W.; Ramalingam, S. (Texas A and M Univ., College Station (USA). Dept. of Mechanical Engineering). Apr 1988. Contract FG22-85PC80528. 197p. NTIS, PC A09/MF A01. Order Number DE88011511/JAW.

While most of the fundamental combustion experiments were performed with a stream of coal/char particles and practical burners which used dense clouds of drops and particles in sprays, the theory used to interpret the experimental data was essentially based on the individual particle combustion model (IPC). As opposed to the IPC model, a group theory is now emerging for the combustion modeling of a cloud of particles. In simple terms, the group behavior implies the formation of a single flame around a large number of drops/particles rather than flame around each individual drop/particle. In broader terms, such a behavior could also be interpreted as the change in burning characteristics due to collective behavior of a cloud of particles. The objectives of the program are (1) to formulate a group theory for the combustion modeling of a cloud of particles, (2) to obtain results on the pyrolysis yield and the ignition and combustion characteristics under cloud conditions, and (3) to compare the results with the experimental data reported elsewhere. An introduction to group combustion theory (GC) is given. A group combustion theory has been formulated and results were obtained for the quasi-steady (QS) group combustion of a cloud of char particles and non-steady (NS) group combustion of coal particles. The QS results for a spherical cloud of char particles are given in terms of a dimensionless group combustion number G.

56076 **(DOE/PC/90279—T14) Advanced coal-fueled combustion for residential space heating applications: Phase 1, Final report.** Kwan, Y.; Chen, S.L.; Ruth, L.A. (Energy and Environmental Research Corp., Irvine, CA (USA)). May 1988. Contract AC22-86PC90279. 147p. NTIS, PC A07/MF A01. Order Number DE88017221/JAW.

Recent technological developments offer the prospect that coal/liquid mixtures or dry ultrafine coal can be utilized in residential space heating applications. The current program has as its objective the development and performance verification of one or more coal slurry, ultrafine coal dust, or dual-fueled prototype combustors suitable for integration into a residential space heater. This program is organized into two phases: Phase I, Combustor Definition, was to develop and evaluate several combustors; and Phase II, Prototype Verification, is to utilize the results from the first phase to develop and test one or more combustors in the contest of a prototype residential space heater system.

56077 **(DOE/PC/90756—T3) Research on thermophoretic and inertial aspects of ash particle: Deposition on heat exchanger surfaces in coal-fired equipment: Quarterly technical report, June 1, 1988--August 31, 1988.** Rosner, D.E. (Yale Univ., New Haven, CT (USA). Dept. of Chemical Engineering). Sep 1988. Contract FG22-86PC90756. 8p. NTIS, PC A02/MF A01. Order Number DE89001385/JAW.

DOE-PETC has initiated at the Yale HTCRE Laboratory a systematic three-year experimental and theoretical research program directed toward providing engineers with the data, methods, and rational correlations needed to improve the generality and accuracy of prediction of inorganic particle deposition rates under typical coal combustion conditions i.e., those leading to the importance of thermophoretically-enhanced diffusion (submicron mode) and the inertially-enhanced "impaction" (supermicron mode), often in the presence of simultaneous alkali salt vapor condensation. After a brief statement of objectives (Section 2) we outline our experimental and theoretical progress during this quarterly reporting period (Section 3), with our results summarized in the references documented in Section 5. Section 4 gives relevant administrative information (personnel, research plans). 15 refs., 3 figs.

56078 **(KTM/E-D—149) Effects of fuel peat quality management on a heating power plant.** Kautto, J.; Impala, R.; Kaipainen, H.; Martikainen, P.; Miettinen, M.; Saarinen, T. (Valtion Teknillinen Tutkimuskeskus, Jyvaeskylae (Finland). Kotimaisten Polttoaineiden Lab.). (Kauppa-ja Teollisuusministerio, Helsinki (Finland). Energiaosasto). Jan 1988. 52p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754859/JAW.

In this research all the phases in peat delivery from bog to boiler were optimized and matched. Quality requirements of the peat set by the boiler were densified into curves. It was found out that the intermetiate storage is homogenizing quality fluctuations, but because of it's small volume the storage does not give extra flexibility to the deliveries. Utilizing optimized delivery plan made it possible to fullfill requirements of the boiler without spending extra money on the transport.

56079 **Apparatus for measuring slag or ash in a furnace.** Mathur, M.P.; Ekmann, J.M. US Patent Application 6-016,900. 20 Feb 1987. 15p. NTIS, PC A03/MF A01.

The buildup of slag or ash on the interior surface of a furnace wall is monitored by disposing two coils to form a transformer which is secured adjacent to the inside surface of the furnace wall. The inductive coupling between the two coils of the transformer is affected by the presence of oxides of iron in the slag or ash which is adjacent to the transformer, and the application of a voltage to one winding produces a voltage at the other winding that is related to the thickness of the slag or ash buildup on the inside surface of the furnace wall. The output of the other winding is an electrical signal which can be used to control an alarm or the like or provide an indication of the thickness of the slag or ash buildup at a remote location.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 56521

56080 **(DOE/PC/72571—T14) Market and equipment performance analysis for the application of coal-based fuels/advanced combustion systems: Technical/economic assessment of coal-fired slagging combustors.** (USDOE Pittsburgh Energy Technology Center, PA; Burns and Roe, Inc., Oradell, NJ (USA)). Mar 1986. Contract AC22-84PC72571. 191p. NTIS, PC A09. Order Number DE88016494/JAW.

Advanced slagging combustors were assessed for market potential and cost effectiveness as retrofits for the utility industry assuming that such slagging combustors achieve 90% ash rejection and 50% SO_2 capture, with a maximum boiler derating of 10%. A 12,000 Btu/lb design coal with a 10% ash and 3% sulfur content was utilized. The cost effectiveness of the slagging combustors was based on a four-year payback period for systems meeting emission limits of 0.03 lb of particulates/MMBtu, 0.6 lb of NO/sub x//

MMBtu and 1.2 lb of SO_2/MMBtu. Baghouses and dry scrubbers were used to achieve these emission limits. A market analysis identified 193 oil-fired utility installations (54,000 MW, 2.8 Quads) as potential slagging combustor conversion candidates. Four case study units were selected based on geographic distribution, range of capacities, and difference of manufacturer and firing type. This report discusses the results of these analyses.

56081 (TYOT-JULK—294) Small-scale peat production in Finland. Eilavaara, E. (Tyotehoseuran Julkaisuja, Helsinki (Finland)). Nov 1987. 103p. (In Finnish). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88754916/JAW.

The study conducted by the Work Efficiency Institute as a questionnaire sent through the mail examined the extent of small-scale peat production in Finland and the methods currently used. The basis of the study were 318 addresses. The questionnaire was filled and returned by 262 (82%) producers and 190 of them (60%) were included in the final analysis. According to the results, there were 136 small-scale sod peat producers in Finland in 1984. In small-scale peat production peat is generally produced for consumption on the property where it is produced using the farm's own machines and labour force. Small-scale production usually takes the form of sod peat production. In comparison with the results obtained in a similar questionnaire study carried out in 1981, small-scale production has undergone considerable growth and mechanization. The number of producers has almost doubled. The volume of sod peat produced per producer has quadrupled. Reason leading to this include, for instance, increased markets for sod peat and the development of machinery suited for small-scale production.

0160 Health And Safety

REFER ALSO TO CITATION(S) 56048, 56054, 56060, 56070, 56071

56082 (IMMR—85-03B) Survey of safety sign usage in underground Kentucky coal mines. McCoy, D.F. (Kentucky Univ., Lexington (USA). Inst. for Mining and Minerals Research). Aug 1985. 25p. University of Kentucky, Lexington (USA). Behavioral Research Aspects of Safety and Health Group.

Information on the use of safety signs was obtained from more than 200 mines in Kentucky by means of a telephone questionnaire with the aim of gaining an understanding of the 'State of the art' of sign usage in the Kentucky underground coal mining industry. All the mines reported using some sort of signing system, but most used relatively few types of sign. There was little or no consistency between mines regarding the specific type of sign (ie., the message), the colour, the shape, or the location of the signs. Most of the signs were constructed of some type of reflective materials and were limited to what was commercially available. Some of the signs used were homemade. Most of the sign messages were transmitted with words rather than symbols, although some used both words and symbols. The signs were located wherever convenient. The report concludes that there is a definite need for a consistent set of regulations regarding safety sign usage in Kentucky mines and makes recommendations regarding the design of these signs.

56083 (IOM-TM—88-01) Studies on the cellular response in lung tissue to the inhalation of mineral dust. Donaldson, K.; Bolton, R.E.; Brown, D.M.; Brown, G.M.; Cowie, H.A.; Jones, A.D.; Robertson, M.D.; Slight, J.; Davis, J.M.G. (Institute of Occupational Medicine, Edinburgh (UK)). Mar 1988. 145p. Institute of Occupational Medicine, Edinburgh, United Kingdom.

The prevalence of coalworkers' pneumoconiosis varies between different collieries in Britain and this has been shown to be related to differences in the mineral content of coalmine dusts which are present in the air of the coalmines. As in other forms of parenchymal fibrosis, the pathobiological processes which lead to pneumoconiosis are considered to be mediated, in large part, by pulmonary leukocytes which can be altered in number and activity by the presence of deposited dust. A study was therefore designed to investigate whether dusts collected from British coalmines of different rank, and hence with different mineralogical content, would produce differences in bronchoalveolar leukocyte response in rats exposed to the dusts by inhalation. To this end, airborne dusts were collected from three collieries producing coals of different type:- anthracite, high rank coking coal and low rank bituminous coal. These dusts were generated as respirable clouds of 10 and 50mg/m^3 in purpose built chambers and groups of rats were exposed for up to 75 days. Rats were also exposed, at similar airborne mass concentrations, to the control dusts quartz and titanium dioxide (TiO_2); kaolinite at 50mg/m^3 was also used. Rats exposed for 32 or 75 days and allowed to breathe room air for 2 further months were also studied. Groups of 4 rats were removed from the exposure chambers on days 2, 4, 8, 16, 32, 52 and 75 and were analysed for bronchoalveolar leukocyte response by analysis of bronchoalveolar lavage profile. Exposure to coalmine dust at airborne mass concentrations of 10 and 50mg/m^3 caused marked alveolar inflammatory responses, but no reliable difference in ability to cause inflammation was detected for dusts from different rank coals.

56084 (IOM-TM—88-05) Animal studies to investigate the deposition and clearance of inhaled mineral dusts. Jones, A.D.; Vincent, J.H.; McMillan, C.H.; Johnston, A.M.; Addison, J.; McIntosh, C.; Whittington, M.S.; Cowie, H.; Parker, I.; Donaldson, K.; Bolton, R.E. (Institute of Occupational Medicine, Edinburgh (UK)). Apr 1988. 166p. Institute of Occupational Medicine, Edinburgh, United Kingdom.

The influence of various factors (including electrical charge, exposure concentration, duration of exposure and particle toxicity) on the deposition and clearance of inhaled mineral dusts was investigated in experiments with rats exposed to dust for 7 hours per day, 5 days per week. Lung burdens of rats exposed to charged or neutralized mineral aerosols were found to be not significantly different, but lung burdens of rats exposed to either a toxic dust (quartz) or a relatively non-toxic dust (titanium dioxide) scaled with respect to exposure concentration and increased progressively with exposure time. Lung burdens of these rats decreased with time post-exposure and transfer to lymph nodes appeared to commence when the lung burden reached a threshold which was higher (1800μm) for the non-toxic dust than for the toxic dust (900μm). For rats exposed to coalmine dusts collected from either an anthracite mine or one mining a low rank coal, retention post-exposure appeared to be greater for the anthracite dust with significantly faster transfer to the lymph nodes than for the low rank dust.

56085 (IOM-TM—88-08) Physical fitness of mines rescue workers. Love, R.G.; Graveling, R.A. (Institute of Occupational Medicine, Edinburgh (UK)). Jun 1988. 30p. Institute of Occupational Medicine, Edinburgh, United Kingdom.

There is constant concern in the Mines Rescue Service of British Coal that its members, whether full or part-time, should be of sufficient physical fitness to carry out their duties in an emergency without jeopardising the safety of their colleagues in the rescue team. The current position with regard to fitness testing procedures in the rescue service is described and compared with the situation in the Fire Service and other organisations where physical fitness is considered to be a prerequisite of membership. The potential disadvantages of using a fitness index originally derived from the near-maximal Harvard Pack Test and applying it to a submaximal treadmill test are discussed. The available submaximal tests are reviewed for their usefulness to predict physical fitness and the different modes of testing (treadmill, bicycle ergometer, etc.) and test protocols are described. The inherent inter and intra-test variability of such tests, the use of submaximal or maximal tests and their relative advantages and disadvantages are also discussed with a view to recommending improvements in the test currently used in the Mines Rescue Service. In particular, it is suggested that a fundamental reappraisal is made of the way in which the test is used, in order to avoid too much reliance on the rigid pass/fail point given by the derived Harvard Pack Index.

56086 **(PB—88-229885/XAB) Case evaluation of a surface seismic-reflection technique for delineating coal-bed discontinuities. Report of Investigations/1988.** Molinda, G.M.; Ingram, D.K. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1988. 35p. (BM-RI—9147). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600305.

Coal-bed discontinuities historically have been hazardous to mining as well as obstructions to efficient production. An effective means of mapping these features is needed in order to plan safe and efficient mine development. This report discusses the use of surface seismic techniques for this purpose. At a southwestern Pennsylvania mine, a system of coal-bed discontinuities (paleochannels) was accurately mapped by the Bureau of Mines using borehole log methods and underground observation. The site was chosen to test the value of a high-resolution surface seismic-reflection technique for coal-bed mapping.

56087 **(PB—88-230248/XAB) Size scaling of gas explosions: Bruceton Experimental Mine versus the Lake Lynn Mine. Report of Investigations/1987.** Sapko, M.J.; Weiss, E.S.; Watson, R.W. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 20 Feb 1987. 30p. (BM-RI—9136). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600189.

Single-entry gas-explosion characteristics for the Bruceton Experimental Mine (BEM) are compared to those occurring in the larger geometries of the new Lake Lynn Mine (LLM) within the Lake Lynn Laboratory. (All three are Bureau of Mines facilities). Scale factors and boundary conditions for the BEM and the larger entries of the LLM are reviewed in some detail using representative data for pressure, flame, and wind velocity in the two mines. Measured pressure histories for gas explosions at the BEM are compared with data for comparable explosions in the larger cross section of the LLM. The time evolution for flame-front displacment can be characterized by a general expression that relates gas concentration and length of flammable volume. The course of the explosion development and its destructive power are dependent upon the development of turbulence in the unburned flammable mixture into which the flame propagates. The results of the study indicated that pressure profiles in the larger cross section are maintained to much larger, distances even though the flame front is accelerated less rapidly in a comparable entry length of smaller flammable volume.

0170 Legislation And Regulations

REFER ALSO TO CITATION(S) 56041

02 PETROLEUM

0201 Reserves

REFER ALSO TO CITATION(S) 56757, 56758, 56759, 56760, 56761

0202 Geology And Exploration

REFER ALSO TO CITATION(S) 56095

56088 (CONF-8704112—, pp 380-382) **Determination of ^{129}I in heavy residues of two crude oils.** Fehn, U.; Tullai, S.; Teng, R.T.D.; Elmore, D.; Kubik, P.W. (Univ. of Rochester, NY (USA)). 1987. Elsevier Science Publishers Co. Inc., 52 Vanderbilt Ave., New York 10017. Order Number TI88013520/JAW.

From 4. international symposium on accelerator mass spectrometry; Ontario, Canada (27 Apr 1987).

$^{129}I/^{127}I$ ratios were determined in heavy residues of two crude oils which were produced from 10 Ma and 300 Ma old formations. The measured $^{129}I/^{127}I$ ratios were between 5 and 10 x 10^{-12}. These values are significantly above the ratios determined for marine sediments and, for the older oil, also above those supported by in situ production of ^{129}I from uranium. The authors attribute the high level of ^{129}I in the residues to addition of anthropogenic iodine during the production of the oils. The ratios indicate also that more than 90% of the iodine measured came originally from the oils.

56089 (CONF-8704112—, pp 383-386) **Iodine extraction from petroleum for analysis of $^{129}I/^{127}I$ ratios by AMS.** Tullai, S.; Tubbs, L.E.; Fehn, U. (Rochester Institute of Technology, NY (USA)). 1987. Elsevier Science Publishers Co. Inc., 52 Vanderbilt Ave., New York 10017. Order Number TI88013520/JAW.

From 4. international symposium on accelerator mass spectrometry; Ontario, Canada (27 Apr 1987).

A carrier-free method for extracting low levels of iodine from petroleum residues is described for the use in isotopic analysis by accelerator mass spectrometry (AMS). The petroleum samples, containing approximately 1 ppm I, are heavy, highly viscous residues left from high temperature distillations. The method is a solvent extraction using toluene as the solvent, and sodium biphenyl as an organic halogen reagent. Iodine is extracted with up to 90% efficiency.

56090 **(ORNL/TM—10897) Estimating finding rates for US crude oil.** Christiansen, D.S.; Reister, D.B. (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 33p. NTIS, PC A03/MF A01. Order Number DE89001629/JAW.

In this paper we provide estimates of both exploratory and developmental finding rate equations for crude oil for six onshore regions in the lower 48 United States. We estimate the finding rate in two different ways—one based on the relationship between the finding rate and cumulative reserve additions (a "derivative approach") and one based on the relationship between cumulative reserve additions and cumulative drilling (an "integral approach"). We develop the integral approach according to two different methods. We investigate differences in finding rates between approaches and between regions. The regional data set is included as an appendix. 8 refs., 3 figs., 6 tabs.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 56090, 56101, 56180, 56181, 56182, 56502, 57662

56091 (ALCRC—RRTAC87-3, pp 24-36) **Alberta's major drilling mud systems and their composition.** Ziedler, H.V. (National Mud Control Laboratories, Calgary, Alta.). 1987. Alberta Envorinment, Standard Life Centre, 14th Floor, 10405 Jasper Ave., Edmonton, Alta., CAN T5J 3N4; $N/C; MFCANMET/TID, Energy, Mines and Res. CAN 555 Booth St., Ottawa, Ont., CAN K1A 0G1; $10 CAN. (CONF-8504337—; MICROLOG—88-04306).

From Gel and saline drilling wastes in Alberta workshop; Edmonton, Canada (23 Apr 1985).

This report describes drilling mud systems as general classes and then deals with the families of additives used and the reasons for their use in each mud system type. A brief discussion of drilling mud functions is presented first, outlining mud utilization for particle removal, wellbore stability, wall building, and cooling and lubrication, along with the properties of the mud relevant to each use. Drilling muds are classified into water based and oil based systems; only water based solid-liquid systems are discussed further. These muds include native muds, using water only, with drilled formation solids used to provide necessary viscosity for particle removal; clear water drilling fluid, with lime, calcium chloride and a polymer for flocculation of the drilled solids; bentonite viscosified mud, and various extended and polymer viscosified systems; and saline water based mud systems, using salts such as KCl to inhibit water sensitivity. Additives are used to deal with problems associated with contamination and high formation pressures. Additives discussed in this paper are: Ca, carbonate/bicarbonate, and pH control additives; bactericides; corrosion inhibitors and scavengers; defoamers; lubricants; shale control inhibitors; thinners, i.e. dispersing agents, dispersants, or deflocculants; and weighting materials.

56092 **(AU—85-87) Steam injection experiments in scaled physical models. Final report, July 1, 1985 - June 30, 1987.** Ali, F.S.M. (Alberta Univ., Edmonton (Canada)). 1987. 490p. (MICROLOG—88-03907). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This research was directed toward a theoretical and experimental study of steamflooding variations with the objective of optimizing oil recovery from thin, heavy oil formations, with bottom water present in many instances. This study deals with the mathematical simulation of steam injection processes, with special reference to thermal upgrading of oil, non-Newtonian oil rheology and injection of foam. In addition, a number of steam injection strategies were studied for bottom water heavy oil reservoirs. Both steamfloods and cyclic steam stimulation were simulated for partially penetrating wells. It was found that if the oil is shear thinning, oil recovery and oil-steam ratio are likely to increase. Thermal upgrading may lead to a small recovery increase, if long times are involved. Foam was not particularly effective in increasing oil recovery. Also studied was the case of multiple layer steam injection from a single tubing, using a wellbore heat loss model for multiple offtake. In this case it was found that the steam quality can vary considerably, with the lower zone taking steam of lower quality. The case of gas injection with steam was investigated for cyclic steam stimulation, and the oil-steam ratio was found to increase only marginally. scale model was designed to represent 1/4 of an 8-hectare 5-spot pattern; 23 experiments were conducted, including continuous steamfloods into homogeneous and bottom water packs, gas injection, steamflood using horizontal wells, and solvent injection. It was found that by injecting an inert gas prior to steamflooding, the effect of thick bottom water zones was minimized, and oil recovery was improved. 79 refs., 196 figs., 90 tabs.

56093 **(AU—1988) CFER Centre for Frontier Egnineering Research annual report, 1986-87.** (Alberta Univ., Edmonton (Canada)). [1988]. 21p. (MICROLOG—88-00439). Centre for Frontier Engineering Research, C-FER Building, University of Alberta Campus, Edmonton, Alta., Canada T6G 2E2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Centre for Frontier Engineering Research is a non-profit research institute of the University of Alberta. Its mandate is to address those problems specifically related to materials, design and construction of facilities used in the development of Canada's petroleum resources on both the geographical frontiers of the Arctic and offshore, and on the technological frontiers of conventional, heavy oil and oil sands operations. Research is focused on two major programs: Offshore Structures, and Downhole Tubular Systems. A third program aimed in improvements in productivity for shipyards and steel fabricating plants is in the developmental stage. This report describes the year's activities of the Centre and also includes activities related to networking and university collaboration. Financial statements are included.

56094 **(CIM—1988) Measurement of geological phenomena related to sand production in heavy oil.** (Canadian Inst. of Mining and Metallurgy, Montreal, Quebec). 1988. 33p. (CONF-8805204—; CE—01930). Petroleum Society of the CIM, 229 - 640 Fifth Ave., S.W., Calgary, Alta., Canada T2P 3G4; $10.00 CAN.

From 90. CIM annual general meeting; Edmonton, Canada (8 May 1988).

One of the concerns that heavy oil producing companies have is the unwanted production of sand. The sand production can vary from well to well in a seemingly random fashion. As such the phenomena has been difficult to predict in the Mannville sands in the Lloydminster area of Alberta. This presentation will discuss the interim results of a sanding study that is being completed in one field in the Lloydminster area. The paper outlines how the study was initiated, progress to date, the evaluation procedures, and how they relate to the geological phenomena in the area studied. It was observed that one thermal project had initial high servicing mainly due to sand production. During a thorough review of all gamma spectrometry logs, it was found that the data had more potential than to simply identify zones with oil potential. A theory was subsequently developed that identification of sand-producing horizons was possible. Tests involving an existing well and new well completions substantiated the theory for this resevoir. The sanding presentation is a modification and an enhancement of the existing gamma log interpretation. These log data can be used for the interpretation of sand quality, including the evaluation of cementing and bridging materials within the reservoir. 2 refs., 13 figs.

56095 **(RF/SPT/T—6/87) Production from thin oil zones.** Ekrann, S. (Rogalandsforskning, Stavanger (Norway)). Sep 1987. 161p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88754877/JAW.

The report reviews available theory on production from thin oil zones. Possible production methods are discussed, including field experience. Norwegian fields exhibiting thin oil zones are described, and a rough quantitative evaluation is performed. Rescarch topics, suited for the SPOR program (State R and D Program for improved Oil Recovery and Reservoir Technology Program) are suggested. 52 drawings, 12 tables. 150 references.

0204 Processing

REFER ALSO TO CITATION(S) 56010, 56111, 56183

56096 **(GERAD—G-85-26) Modeling of refineries in MARKAL-QUEBEC.** Berger, C. (GERAD Ecole des Hautes Etudes Commerciales, Montreal, Quebec (Canada)). Dec 1985. 149p. (In French). (CE—01948). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The main objective of this study is to introduce a model which can show how the present structure of the Quebec refining industry can evolve in the future in order to respond advantageously to future needs. This model has been constructed around the MARKAL energy analysis program. The structure of this model is presented and the data from the introductory chapters on petroleum refining processes are used to show how a refinery model can be constructed using MARKAL. Some suggestions are given on the modifications applicable to MARKAL in order to bring it more into line with certain peculiarities of the refining industry, with a view to improving the performance of programs which generate matrices and reports. Data tables are given throughout the report for use with the modelling of various refinery processes. 141 refs., 17 figs., 57 tabs.

0205 Products And By-products

REFER ALSO TO CITATION(S) 56378

0206 Health And Safety

REFER ALSO TO CITATION(S) 56119, 57261, 57263, 57264, 57265

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 56756

56097 **(AEC—88) Alberta Energy Company Ltd. 1987 annual report. Turning resources into opportunities.** (Alberta Energy Co. Ltd., Edmonton (Canada)). [1988]. 41p. (MICROLOG—88-03835). Alberta Energy Company Ltd., 1200, 10707-100 Avenue, Edmonton, Alta., Canada T5J 3M1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Alberta Energy Corporation is active in synthetic and conventional oil production, gas production, wood products, pipelines, and joint ventures including coal and fertilizer. Petroleum and natural gas interests are held in western Canada and the Beaufort Sea, and oil sands interests in Alberta. The Corporation also owns sub-

stantial interest in Chieftain Development, Pan-Alberta Gas, and Pan-Alberta Resources; a 10% interest in the Syncrude oil sand mining operation; majority interest in AEC Power, which supplies power and steam to Syncrude; and other minority interests in an anhydrous ammonia plant, an Alberta coal mine, and the IPSCO steel company. The pipeline-related activities of the Corporation include the Alberta Oil Sands Pipeline, the Cold Lake Heavy Oil Pipeline, the Alberta Ethane Gathering System, and the Wabasca River Pipeline, the last two as a minority interest. Forest product activities include lumber and fiberboard production. This report details the year's activities of the company and includes financial statements.

56098 **(CIM—1988) Marketing, the new challange for crude oil producers in Canada.** (Canadian Inst. of Mining and Metallurgy, Montreal, Quebec). 1988. 25p. (CONF-8805204—; CE—01926). Petroleum Society of the CIM, 229 - 640 Fifth Ave., S.W., Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

From 90. CIM annual general meeting; Edmonton, Canada (8 May 1988).

This paper discusses crude oil marketing in Canada, which is a relatively new activity. Until around 1985, production and pricing were closely regulated, and incentives for marketing crude oil at the producer's level did not in effect exist. However, the implementation of the Western Accord in June 1985 effectively eliminated regulated pricing and export controls. This has meant producers have to understand markets, transportation systems, pricing mechanisms, and marketing skills, and be exposed to the risks of the market place. Among the subjects outlined in this paper are the nature of the Canadian crude oil transport system, the types of crude being produced, use of the futures market to manage prices, possible effects of the Canada-USA Free Trade Agreement, the changes in the Canadian production mix, changes in transportation expected when new frontier sources come on stream, and changes in Canadian crude oil quality. 5 figs., 1 tab.

56099 **(DOE/EIA—0380(88/07)) Petroleum marketing monthly, July 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 30 Sep 1988. 172p. NTIS, PC A08/MF A01 - GPO. Order Number DE89001012/JAW.

International crude oil spot markets staged a modest recovery in mid-July, although continued high levels of production, particularly within the Organization of Petroleum Exporting Countries (OPEC), made long term market strength appear unlikely. Crude oil output was held down slightly by temporary situations, including the explosion of the Piper Alpha platform in the North Sea and damage to a Colombian export pipeline. However, production in excess of OPEC quotas by several of its member countries pointed to a continuing surplus of crude oil on world markets in the immediate future. In the United States, the composite refiner acquisition cost of crude oil fell $1.08 per barrel, or 6.9 percent, to an average of $14.63 per barrel for July. Because of the continual slide in crude oil prices throughout June, the late-July price turnaround was not sufficient to result in an increase in the average price for the month. Total refiner sales statistics for the major petroleum products showed a 2.6 percent decrease from June. 12 figs., 53 tabs.

56100 **(MEM/P—88) Oil in Manitoba.** (Manitoba Dept. of Energy and Mines, Winnipeg (Canada). Petroleum Div.). [1988]. 41p. (MICROLOG—88-03855). Manitoba Dept. of Energy and Mines, Legislative Bldg., Rm. 301, Winnipeg, Man., Canada R3C 0V8; $N/C; MF CANMET/TID, Energy, Mines and Resources CAN, 555 Booth St., Ottawa, Ont., CAN K1A 0G1; $10 CAN.

While its oil industry is small compared to those of its neighbors, Manitoba is nevertheless an active participant in Canada's oil industry. This publication offers an overview of Manitoba's petroleum industry, providing a simple, non-technical introduction to Manitoba petroleum geology and oil production processes. Exploration activity in Manitoba dates from 1877, with the first producing gas wells drilled in 1922. Concentrated searching truly began only in the late 1940s, with the first commercial oil discovery being made in 1950. This well resulted in the first commercial production from the now-prolific Williston Basin. By 1952 the first major oil field, the Daly, had been discovered; to the end of 1987, this field had produced a total of ca 26 million bbl of oil. Oil booms occurred in the 1950s and 1980s. Refining started in the province in 1927, but excess capacity and stringent environmental standards caused the last operating refinery to close in 1983. The industry today is still active in exploration and drilling and in oil and gas production, 1987 oil production being valued at about $110 million. Productive oil formations total four, with a number of pre-Mississippian formations in the southwest having hydrocarbon potential. This publication also contains a summary of the responsibilities and activities of the Petroleum Divison of Manitoba Energy and Mines, and a glossary of technical terms. 48 figs. production

56101 **(MEM/P—MG-15454) Manitoba oil activity review, 1987.** (Manitoba Dept. of Energy and Mines, Winnipeg (Canada). Petroleum Div.). Apr 1988. 62p. (MICROLOG—88-03856). Manitoba Dept. of Energy and Mines, Legislative Bldg., Rm. 301, Winnipeg, Man., Canada R3C 0V8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In an annual survey of Manitoba's petroleum industry, data are presented on oil lease and reservation sales, geophysical activity, exploration and drilling activity, production, exports to other provinces and USA, oil prices and sales value, royalties and taxes, direct revenues from oil explorationa nd development, reserves, industry expenditures, and oil fields. Throughout the report, explanations are given of the items covered. Descriptions are made of new developments, the oil market, oil policies, incentive programs, and industrial activities. A forecast for the following year is outlined. 18 figs., 19 tabs.

0208 Waste Management

REFER ALSO TO CITATION(S) 56037

56102 **(ALCRC—RRTAC87-3, pp 136-148) Drilling wastes as a soils componenent.** Palmer, C.J. (Environment and Protection Service, Edmonton, Alta.). 1987. Alberta Environment, Standard Life Centre, 14th Floor, 10405 Jasper Ave., Edmonton, Alta., CAN T5J 3N4; $N/C MFCANMET/TID, Energy, Mines and Res., CAN 555 Booth St., Ottawa, Ont., CAN K1A 0G1; $10 CAN. (CONF-8504337—; MICROLOG—88-04306).

From Gel and saline drilling wastes in Alberta workshop; Edmonton, Canada (23 Apr 1985).

The objectives of this paper are to explain the factors which should be evaluated when considering the land disposal of wastes, and to evaluate a saline drilling waste as to its suitability for land farming. Land disposal has been shown to be an economical and efficient means of dealing with a wide variety of industrial and municipal wastes. A prime consideration for any land disposal scheme is to maintain or improve the quality of soil and groundwater resources. A significant component of a saline drilling waste is the solids fraction. The suitability of the solid fraction of a waste for land disposal can be evaluated by comparing it to soil and the properties of soil that can determine a soil's productivity. A rate of application of waste to soil can then be calculated which results in the optimum properties for the amended soil. The evaluaton of the saline drilling waste indicates that it could be used to improve soils of low pH and sandy texture. The land limiting components of the waste are considered to be the salinity and sodicity factors. The sodicity hazard could possibly be alleviated through the application of gypsum. Three options to consider in addressing a salinity hazard include spreading small amounts over large acreages, spreading at a rate which creates a short-term, but acceptable, salinity problem, and applying the solid fraction of a waste after removing excess salt through filtering, leaching or washing. 2 refs., 1 fig., 3 tabs.

56103 (ALCRC—RRTAC87-3, pp 118-122) **Drilling waste management by Public Lands Division field staff.** Lloyd, D.A. (Dept. of Forestry, Land and Wildlife, Edmonton, Alta.). 1987. Alberta Environment, Standard Life Centre, 14th Floor, 10450 Jasper Ave., Edmonton, Alta., CAN T5J 3N4; $N/C; MFCANMET/TID, Energy, Mines and Res., CAN 555 Booth St.,Ottawa, Ont., CAN K1A 0G1; $10 CAN. (CONF-8504337—; MICROLOG—88-04306).

From Gel and saline drilling wastes in Alberta workshop; Edmonton, Canada (23 Apr 1985).

This paper covers the procedures used in the Alberta Public Lands Division for drilling waste disposal, plus the regulatory considerations and other concerns with such disposal and areas for future discussion and research. The Division manages all non-forested Crown land in Alberta and is responsible for any activity that affects the inherent quality of these lands. The preferred sump disposal method consists of spreading the muds on the land and covering it with topsoil, where feasible. In areas such as the oil sand regions where large sump volumes are produced, the disposal methods encouraged are to use detoxification, spreading, and burying. Regulatory backing for sump fluid treatment and disposal requirements is provided by the Oil and Gas Conservation Regulations and by the Public Lands Act.

56104 (ALCRC—RRTAC87-3, pp 88-117) **Drilling mud and brine waste disposal.** Crabtree, A.F. (Dept. of National Resources, MI, USA). 1987. Alberta Envorinment, Standard Life Centre, 14th Floor, 10405 Jasper Ave., Edmonton, Alta., CAN T5J 3N4; $N/C; MFCANMET/TID, Energy, Mines and Res. CAN 555 Booth St., Ottawa, Ont., CAN K1A 0G1; $10 CAN. (CONF-8504337—; MICROLOG—88-04306).

From Gel and saline drilling wastes in Alberta workshop; Edmonton, Canada (23 Apr 1985).

This paper begins with a description of the oil and gas well drilling practices in Michigan, normally using water-based drilling muds with either fresh or salt water. The problems associated with drilling fluid disposal, and associated disposal of brines produced in typical wells, are then presented. Regulations require environmentally sound disposal especially in light of the state's vulnerability to ground water contamination. There are different methods of handling the brine wastes encountered in well drilling: drilling fluids are disposed into mud pits, with regulations specifying proper sealing of pits and avoiding spillage; pit brines, those brines temporarily held in open pits which are often subject to leakage, are pumped off and used for drilling new wells, disposed down approved brine disposal wells, or used for dust and ice control on roads; and brines produced during oil and gas drilling are mainly disposed down approved brine disposal wells, with ca 2% of produced brines used for road dust and ice control. Restrictions have been placed on such use because of concerns over both inorganic and organic constituents, and contamination of groundwater. As for control and disposal of solid wastes from drilling (cuttings, muds, salt solids and entrained salt fluids) no single strategy has been found effective. Several options are being used and tested: reserve pits, properly lined; reduction of salt by isolating salt solids from fresh water muds, by dissolving salt solids into brines, or by extraction; stiffening of pits to provide physical stability and support for the pit cover; and land disposal. 18 refs., 2 figs., 8 tabs.

56105 (ALCRC—RRTAC87-3, pp 75-87) **Chemically enhanced centrifuging for reducing quantity and cost of gel- and saline-based drilling wastes.** Becker, R.F. (Hitec Research and Development, Inc., Calgary, Alta.). 1987. Alberta Environment, Standard Life Centre, 14th Floor, 10405 Jasper Ave., Edmonton, Alta., CAN T5J 3N4; $N/C; MFCANMET/TID, Energy, Mines and Res. CAN 555 Booth St., Ottawa, Ont., CAN K1A 0G1; $10 CAN. (CONF-8504337—; MICROLOG—88-04306).

From Gel and saline drilling wastes in Alberta workshop; Edmonton, Canada (23 Apr 1985).

This paper describes an Alberta company's development of a method for processing drilling fluid during the drilling operation, in order to return the fluid to the mud system with its original properties intact and therefore reducing problems with handling and disposal of drilling fluid wastes. A typical conventional drilling mud system is depicted, showing disadvantages compared to the new system which uses a unique agglomeration technique that allows the ultrafines to agglomerate in such a manner that they can be mechanically removed. The agglomerate is strong enough to withstand the mechanical separation process but weak enough to allow entrapped water to be removed; the agglomerating chemistry was designed so that the dissolved constitutents of the drilling fluids are not removed or altered. Volumetric analysis shows a significant reduction in fluid used, and can reach a five to ten fold improvement in disposal volume reduction over conventional systems. Data are presented to show that the rheological properties of the drilling fluid remain the same when the fluid is processed using this method. Cost savings for a 220 day hole in the Alberta foothills using a KCl fluid are shown to have reduced the budgeted cost of $170,000, calculated for a conventional fluid system, to $61,000. 10 figs.

56106 (ALCRC—RRTAC87-3, pp 59-74) **Disposal of drilling fluid.** Clark, R. (Neyrford Canada Ltd., Calgary, Alta.). 1987. Alberta Environment, Standard Life Centre, 14th Floor, 10405 Jasper Ave., Edmonton, Alta., CAN T5J 3N4; $N/C MFCANMET/TID, Energy, Mines and Res. CAN 555 Booth St., Ottawa, Ont., CAN K1A 0G1; $10 CAN. (CONF-8504337—; MICROLOG—88-04306).

From Gel and saline drilling wastes in Alberta workshop; Edmonton, Canada (23 Apr 1985).

In this introduction to the basics of drilling fluid disposal, the characteristics of typical drilling mud systems are described along with the properties of muds and their additives. Alberta guidelines for drilling fluid disposal are summarized. The toxic components of such fluids are outlined, including oil, salts, and soluble metallic trace elements. Disposal methods are evaluated, notably trapping (containment), trenching, squeezing (adding fill from one end of the sump), fracturing the ground into round channels, chemical treatment (burning oil, adjusting pH, organics removal, fluid clarification by flocculation), downhole disposal, spreading directly on land, and incineration. Chloride and sodium are noted as significant contaminants and mention is made of assessing their concentration and treating sodium contamination using calcium compounds. Solids control equipment is also discussed, and general recommendations are made regarding toxicity reduction, fluid disposal and site cleanup. 3 figs.

56107 (ALCRC—RRTAC87-3, pp 50-58) **Drilling fluid dewatering.** Clark, R.; Card, D.R. (Neyrford Canada Ltd., Calgary, Alta.). 1987. Alberta Environment, Standard Life Centre, 14th Floor, 10405 Jasper Ave., Edmonton, Alta., CAN T5J 3N4; $N/C; MFCANMET/TID, Energy, Mines and Res. CAN 555 Booth St., Ottawa, Ont., CAN K1A 0G1; $10 CAN. (CONF-8504337—; MICROLOG—88-04306).

From Gel and saline drilling wastes in Alberta workshop; Edmonton, Canada (23 Apr 1985).

This paper describes a dewatering process for treating drilling fluid wastes to produce water and sludge. The process involves taking sump fluid, stirred by an agitator to keep it homogeneous, into a cyclone where solids over 80 microns are removed. The resulting mud is mixed with a regulated dose of flocculants to destabilize the fluid and start flocculation. A polyelectrolyte polymer is used for flocculation in an automatic flocculation station. The resulting fluid is introduced to a fluid bed filter; clarified water is decanted and the flocs descend into a section where they are compacted by an Archimedes screw. Solids capture efficiency is typically over 99%, and the water is of a quality suitable under Alberta regulations for immediate disposal or reuse. The resulting mud can be mechanically handled or stored as is, and can be easily dried. The polymer used to consolidate the solids can be removed by flushing, and is biodegradable. The other chemical used in the process, gypsum, is not hazardous and can be beneficial to the soil if ground disposal is used. The dewatering equipment as outlined above does not remove salts; however, repeated squeezing and dewatering of the mud followed by mixing with fresh water will succeed in reducing the salt in the mud that is available to go into the solution. Treatment costs for a typical sump are estimated to be about $1.25/bbl for treating the water layer and $2.00-$2.50/bbl for the solids layer.

56108 (ALCRC—RRTAC87-3, pp 37-49) **Treatment and disposal of waste fluids from onshore drilling sites.** Specken, G.A. (Spectra Water Processing Ltd., Edmonton, Alta.). 1987. Alberta Environment, Standard Life Centre, 14th Floor, 10405 Jasper Ave., Edmonton, Alta., CAN T5J 3N4; $N/C; MFCANMENT/TID, Energy, Mines and Res. CAN 555 Booth St.,Ottawa, Ont., CAN K1A 0G1; $10 CAN. (CONF-8504337—; MICROLOG—88-04306).

From Gel and saline drilling wastes in Alberta workshop; Edmonton, Canada (23 Apr 1985).

The accumulation and storage of waste materials in open, earthen pits (sumps) during the drilling of onshore oil and/or gas wells leads to an appreciable volume - up to 100,000 barrels per site - of waste fluids of varied composition. Disposal of these sump fluids has become a problem where regulatory bodies no longer allow simple dumping of the fluids to the environment. For instance, in western Canada the clarified water from drilling site sumps must meet certain quality standards, primarily the passing of a trout bioassay, before it can be pumped off-lease. A process has been developed whereby the sump contents are treated in-situ such that a major portion of the total fluid volume is generated to the land. A minor portion of the total fluid volume is left as wet, flocculated solids or sludge in the bottom of the sump pit for burial there or dispsal to the lease area. The various aspects of this treatment and disposal process are discussed, and cost data for two years of commercial operation in western Canada are presented. In some selected cases, the cost data are related to the types of drilling fluid systems used to drill the holes. 3 tabs.

56109 (ALCRC—RRTAC87-3, pp 3-17) **Waste drilling fluid disposal - ERCB directives.** Berndtsson, G. (Energy Resources Conservation Board, Calgary, Alta.). 1987. Alberta Environment, Standard Life Centre, 14th Floor, 10405 Jasper Ave., Edmonton, Alta., CAN T5J 3N4; $N/C; MFCANMET/TID, Energy, Mines and Res. CAN 555 Booth St., Ottawa, Ont., CAN K1A 0G1; $10 CAN. (CONF-8504337—; MICROLOG—88-04306).

From Gel and saline drilling wastes in Alberta workshop; Edmonton, Canada (23 Apr 1985).

This paper reviews the directives on drilling fluid disposal issued by the Energy Resources Conservation Board in Alberta. Off-lease disposal of such wastes needs government approval, and drillers are required to contain liquid waste at all times and to dispose of it in an environmentally sound manner. With trends to drilling deeper wells, hence using larger fluid volumes, additional regulations were necessary. Subsurface disposal, if properly conducted and controlled, is encouraged by the Board. The pertinent regulations prescribe disposal zones below 600 m, and include various provisions for abandoned wells and for wells with casings either cemented or uncemented. Surface disposal is also permitted; conditions outlined in this paper include construction of sumps for on-lease disposal, and fluid treatment standards and approvals necessary for off-lease disposal. For oil field wastes other than drilling fluids, regulations were also upgraded. Copies of the Board directives are included in appendices.

56110 **(ALCRC—RRTAC87-3) Gel and saline drilling wastes in Alberta.** Lloyd, D.A. (Alberta Land Conservation and Reclamation Council, Edmonton (Canada)). 1987. 222p. (CONF-8504337—; MICROLOG—88-04306). Alberta Environment, Standard Life Centre, 14th Floor, 10405 Jasper Ave., Edmonton, Alta., CAN T5J 3N4; $N/C; MFCANMET/TID, Energy, Mines and Res. CAN, 555 Booth St.,Ottawa, Ont., CAN K1A 0G1; $10 CAN.

From Gel and saline drilling wastes in Alberta workshop; Edmonton, Canada (23 Apr 1985).

A seminar was held in Alberta to promote a better understanding between government regulators and industry about various aspects of drilling waste disposal. Presentations were made concerning: the mud components used, their purpose and need; industry experience with drilling and cleanup practices; environmental considerations when disposing of wastes; government regulations, procedures, and concerns; and toxic constituents of drilling wastes. Separate abstracts have been prepared for fifteen papers from this seminar.

56111 **Analysis of residuum desulfurization by size exclusion chromatography with element specific detection. Part II.** Reynolds, J.G.; Biggs, W.R. (Lawrence Livermore National Lab., Univ. of California, Livermore, CA (US)). *Fuel Science and Technology International;* 6: No. 3, 329-354(1988).

Heavy crude residua are analyzed by side exclusion chromatography with element specific detection (SEC-ICP), to elucidate structural information about the S-containing compounds. These compounds appear to fall into two categories: those which are 1) moderately small components (probably thiophenic), and 2) larger components associated with apparent precursors of asphaltenes. The effects of thermal hydroprocessing on the S-containing compounds were also examined. High and moderate thermal severity appear to, in addition to removing S: 1) remove the larger S-containing compounds, 2) shift the total S profile to smaller molecular size, and 3) form S-containing compounds not existent in the feed. Low thermal severity appears to only partially remove the larger S-containing compounds. These results indicate the S-containing compounds behave similarly to the metal-containing compounds under the same processing conditions. Possible binding site relationships between some of the S- and metal-containing compounds in heavy crudes and residua are discussed. The authors observed S and V correlations in both feeds and products, suggesting a relationship between the S and V at the molecular level.

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 56110, 57500, 57617

56112 (ALCRC—RRTAC87-3, pp 181-195) **Environmental, geological and operations considerations when using saline drilling fluids - Shell Canada's experience.** Mead, D.A. (Shell Canada Ltd., Calgary, Alta.). 1987. Alberta Environment, Standard Life Centre, 14th Floor, 10405 Jasper Ave., Edmonton, Alta., CAN T5J 3N4; $N/C; MFCANMET/TID, Energy, Mines and Res. CAN, 555 Booth St.,Ottawa, Ont., CAN K1A 0G1; $10 CAN. (CONF-8504337—; MICROLOG—88-04306).

From Gel and saline drilling wastes in Alberta workshop; Edmonton, Canada (23 Apr 1985).

This paper presents Shell Canada's environmental policy regarding saline drilling wastes and company responsibility for dealing with wastes, the rationale behind Shell's decision to use saline drilling muds (primarily KCl), current experience in use of such muds, and practical considerations associated with constructing and cleaning up drilling locations and sumps. Shell policy is to dispose of wastes in an ethical and environmentally safe manner. Potential problems associated with Shell's use of KCl muds include soil contamination and contamination of water used in agriculture and the home. Experience has not yet revealed any problems; mud handling systems have been developed that maximize reuse of mud and minimize the use of fresh water, and a pit system for waste handling and disposal uses encapsulation of wastes in compacted clay. 2 figs., 3 tabs.

56113 (ALCRC—RRTAC87-3, pp 157-167) **Some degradative capabilities of soil microbes, with reference to drilling waste organic additives.** Foght, J. (Univ. of Alberta, Edmonton). 1987. Alberta Environment, Standard Life Centre, 14th Floor, 10405 Jasper Ave., Edmonton, Alta., CAN T5J 3N4; $N/C; MFCANMENT/TID, Energy, Mines and Res. CAN 555 Booth St.,Ottawa, Ont., CAN K1A 0G1; $10 CAN. (CONF-8504337—; MICROLOG—88-04306).

From Gel and saline drilling wastes in Alberta workshop; Edmonton, Canada (23 Apr 1985).

Soil microbes are essential biological components of the soil. Their degradative capabilities are varied, and include both natural and xenobiotic compounds. Degradation of these compounds in soil is influenced by three main factors: physical and chemical environmental parameters; the nature of the compound, and the microbial population. Recent scientific literature regarding the degradation of some specific drilling mud organic additives is discussed. A synthesis of these results allows extrapolations for potential disposal alternatives for drilling muds. 10 refs.

56114 (ALCRC—RRTAC87-3, pp 149-156) **Reclamation of oil and salt water spill sites.** Innes, R. (Hardy and Associates, Edmonton, Alta.). 1987. Alberta Environment, Standard Life Centre, 14th Floor, 10405 Jasper Ave., Edmonton, Alta., CAN T5J 3N4; $N/C; MFCANMET/TID, Energy, Mines and Res. CAN 555 Booth St., Ottawa, Ont., CAN K1A 0G1; $10 CAN. (CONF-8504337—; MICROLOG—88-04306).

From Gel and saline drilling wastes in Alberta workshop; Edmonton, Canada (23 Apr 1985).

This document presents, in outline form, methods for reclaiming hydrocarbon and saltwater spill sites. Procedures are outlined under different types of land as found in Alberta including agricultural land, forest soils, and muskeg. Procedures include inducing biodegradation, monitoring, assessment of toxicity and damage, spill stoppage and containment, and revegetation. 1 fig.

56115 **(ICES-CRR—107) Research activities related to oil pollution incidents.** (International Council for the Exploration of the Sea, Copenhagen (Denmark)). Jul 1981. 51p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754855/JAW.

This report is based on the proceedings of an ad hoc Working Group of ICES, which was set up to consider what scientific studies can and should be initiated in relation to spills of oil at sea. The output of the Working Group was discussed by the Marine Environmental Quality Committee (MEQC) and by the Advisory Committee on Marine Pollution (ACMP), and, in producing this report, comments of these Committees as well as comments from appropriate experts in member countries have been taken into account. While the central matters discussed are those concerned with the sort of scientific program designed to provide information on the effects of spills, the report also ranges over both pre- and post-spill situations. The need for and value of maps of environmental characteristics and resources is emphasised, and the problems discussed. In the area of physical data, the spreading of oil on the sea and its subsequent weathering are considered and the use of models of physical parameters referred to. The contribution from geological expertise is also considered. The various techniques and the available equipment for collecting samples of water, sediments and organisms for study in relation to an oil spill are presented and evaluated. In the field of chemistry, analytical methods are reviewed, problems of interpretation examined, and the need for adequate intercalibration emphasised. Biological effects of oil on all the main components of the ecosystem are separately dealt with, and proposals made for the optimum study program. In view of the importance of microbiological processes, a separate section is devoted to sampling methods in the field. 78 refs.

56116 **(NIPER—351) Proceedings of the symposium on applications of microorganisms to petroleum technology.** Burchfield, T.E.; Bryant, R.S. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Sep 1988. Contract FC22-83FE60149. 329p. (CONF-870858—). NTIS, PC A15/MF A01. Order Number DE88001232/JAW.

From Symposium on applications of microorganisms to petroleum technology; Bartlesville, OK, USA (12 Aug 1987).

The interest in applications of microorganisms in petroleum technology results from the potential low cost and versatility of microbial formulations. With recent declines in oil prices, the petroleum industry has needed an oil recovery technology that can be applied in a cost-effective manner to increase production from declining oil fields. Microbial enhanced oil recovery (MEOR) methods may be able to increase our recoverable oil reserves when oil prices are such that other methods are not economically attractive. The purpose of this symposium was to review the state-of-the-art in development and application of microbial methods to petroleum technology. The focus of the conference was on application of the technology in the field, particularly by independent petroleum producers. Microorganisms can be thought of as minute factories, which produce certain chemical products when provided with an appropriate feedstock and operating conditions. Laboratory studies are required to select, isolate, and adapt the microbial species with the best properties. Microbial methods are attractive for oil recovery applications because bacteria are self-replicating and therefore inexpensive to produce using inexpensive, readily-available nutrient sources, such as molasses. Furthermore, microbes can be chosen which do not pose a threat to the environment, and in the unlikely event that deleterious effects are observed from a microbial treatment, the injection of nutrient can be stopped, or a biocide can be injected to mitigate the problem. Through careful design, microbes can produce a diverse spectrum of chemical products under a variety of conditions and are therefore potentially applicable in many different reservoir environments.

56117 **(PB—88-226048/XAB) Evaluation of satellite-tracked surface drifting buoys for simulating the movement of spilled oil in the marine environment. Volume 1. Executive Summary. Report for 1986-1988.** Reed, M.; Turner, C.; Spaulding, M.; Jayko, K.; Dorson, D. (Applied Science Associates, Inc., Narragansett, RI (USA)). 15 Mar 1988. 19p. NTIS, PC A03/MF A01.

See also PB—88-226055.

The purpose of this study is to evaluate satellite-tracked surface drifters for use in simulating the movement of spilled crude oil and assessing the skill of the Oil Spill Risk Analysis model. Review of the oil-spill literature since 1980 shows that the most-significant advance relative to surface-transport processes relates to the effect of temporary submergence and surface shear on the distribution of oil behind the downwind leading edge of a surface slick. Dynamic analyses of three basic buoy shapes, the sphere, the spar or cylinder, and the disk or flattened spheroid, were undertaken using a numerical model. The results suggest that, two existing drifters, a sphere and a disk, represent the most-promising available surface drifters for simulating the movement of spilled crude oil.

56118 **(PB—88-226055/XAB) Evaluation of satellite-tracked surface drifting buoys for simulating the movement of spilled oil in the marine environment. Volume 2. Final report.** Reed, M.; Turner, C.; Spaulding, M.; Jayko, K.; Dorson, D. (Applied Science Associates, Inc., Narragansett, RI (USA)). 15 Mar 1988. 166p. NTIS, PC A08/MF A01.

See also PB—88-226048.

The purpose of this study is to evaluate satellite-tracked surface drifters for use in simulating the movement of spilled crude oil and assessing the skill of the Oil Spill Risk Analysis (OSRA) model. Review of the oil-spill literature since 1980 shows that the most significant advance relative to surface-transport processes relates to the effect of temporary submergence and surface shear on the distribution of oil behind the downwind leading edge of a surface slick. Dynamic analyses of three basic buoy shapes, the sphere, the spar or cylinder, and the disk or flattened spheroid, were undertaken using a numerical model. The results suggest that, two existing drifters, a sphere and a disk, represent the most-promising available surface drifters for simulating the movement of spilled crude oil.

56119 **(STF—21A87116) Deposition of oily masses after oil protection operations.** Danielsen, A. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Dec 1987. 25p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754902/JAW.

The report discusses oil spills on the sea and presents methods for the treatment and decomposition of oily masses from clean operations. 2 drawings.

56120 **(STF—21A87118) Petroleum on the shore. Decomposition and effects on decomposing chains.** Sveum, P. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Dec 1987. 12p. (In Norwegian). (CONF-8702157—2). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754904/JAW.

From Conference on petroleum and environment; Trondheim, Norway (17 Feb 1987).

The report deals with the environmental effects and decomposition of oil spills on shoreline areas, and focuses on the conditions of decomposing chains in marine sediments. As a part of the ecological processes, the effects from the microbial processes in the various habitats and the mineralization of petroleum on the basis of self-cleaning and fertilization, are discussed. 1 drawing, 22 references.

0210 Legislation And Regulation

REFER ALSO TO CITATION(S) 56109

0220 Transport, Pipelines, And Handling

56121 **(AE—1988) Environmental handbook for pipeline construction.** (Environment Council of Alberta, Edmonton (Canada)). 1988. 90p. (MICROLOG—88-04309). Alberta Environment, Research Management Division, Publications Office, 14th. Floor, Standard Life Centre, 10405 Jasper Ave., Edmonton, Alta., Canada T5J 3N4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This handbook recognizes the potential adverse impact of pipeline construction on the environment and the public in Alberta, and identifies environmental protection measures to minimize those impacts. It is intended for use as a technical reference manual by pipeline owners and contractors, with design and procedures provided as suggestions for developing measures for use during pipeline construction. The handbook has been prepared by reviewing and adapting selected descriptions and drawings of preferred environmental protection measures contained in existing industry manuals, government guidelines and published literature. Only those pipeline construction activities that have potential environmental impact are addressed, and protection measures are provided only for environmental conditions normally found in Alberta. Specific areas of coverage include: construction scheduling, contingency planning, surveys, fences and gates, site clearing, grading, trenching, pipe handling and welding, backfilling, testing, cleanup, and water crossings. 35 refs., 44 figs., 2 tabs.

56122 **(TC/RPC—8206) Energy research and development program. Transport of energy commodities.** (Transport Canada, Ottawa, Ontario. Research Planning and Coordination Branch). 1982. 36p. (CE—01597). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This document describes the overall objectives of Transport Canada's energy research and development programs, and then outlines the subprograms relating to the transport of energy commodities. Specific areas of study include: general studies of energy commodity transportation systems; support systems for Arctic navigation; Arctic ways information studies, including ice forecasting and climatology; Atlantic offshore marine studies, such as weather forecasting and vessel requirements; transport of hazardous energy commodities; Arctic class reseource vessel performance, design, and safety requirements; and transport of coal, including rail, ship, and slurry systems. 3 tabs.

0230 Properties

REFER ALSO TO CITATION(S) 56111

0240 Storage

REFER ALSO TO CITATION(S) 56116

0250 Combustion

REFER ALSO TO CITATION(S) 56080, 57136

03 NATURAL GAS

REFER ALSO TO CITATION(S) 57236

56123 **(CONF-870657—2) Rapid search, statistical analysis, and forecasting using gas industry information with gasLine.** Kruse, J.J.; Klass, D.L. (Institute of Gas Technology, Chicago, IL (USA)). 1987. 21p. Unlimited audience, publicly available. Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. Order Number TI88017164/JAW.

From 4. annual symposium on personal computer applications in the gas industry; Chicago, IL, USA (22 Jun 1987).

gasLine is an on-line interactive database for the storage, interactive search, and rapid retrieval of archival-type gas industry data and information. gasLine is the first on-line database of its kind dedicated to and focused on the gas industry. The database is being established over a three-year period at IGT under the sponsorship of the Gas Research Institute (GRI) and 15 IGT Member companies. gasLine has been available to Charter Subscribers for two years and should be available to the public by the end of 1987. Of particular interest to energy analysts and forecasters is the addition to gasLine of Energy Statistics containing over 6700 time series with much of the data covering 20-year time periods. This data can be downloaded into a spreadsheet file, such as Lotus 1-2-3, to perform additional calculations and manipulations. Similarly, the data can be imported into a sophisticated statistical analysis software program, such as Statgraphics, to perform quick forecasting, time-series analysis, and other statistical manipulations. In addition, a wide variety of graphical presentations and charts can be produced. 8 refs., 2 figs.

0301 Reserves

REFER ALSO TO CITATION(S) 56757, 56758, 56759, 56760, 56761

0302 Geology And Exploration

56124 **(PB—88-239975/XAB) Development of petrophysical techniques for evaluating tight gas sands. Annual technical report, March 1987-February 1988. Final report.** Hunt, E.R.; Luffel, D.L. (ResTech Houston, Inc., TX (USA)). 1988. 178p. NTIS, PC A09/MF A01.

See also annual report dated Mar 1987, PB—87-218905. Color illustrations reproduced in black and white.

Objectives of this program include the establishment of a disc-stored data base or wireline logs, core-analysis data, and measured stress test data; the quantitative evaluation of all wells in the data base for petrophysical properties utilizing methodologies learned during the study; the identification of zones of naturally high in-situ permeability; and the determination of mechanical properties of the rock and surrounding formations for massive hydraulic design. Results of these efforts were documented and compare favorably with production and core data. All of these efforts have resulted in an Integrated Log Analysis System capable of providing the user with detailed information.

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 56091, 56093, 56138, 56502

0304 Products And By-products

56125 **(AHL—82) Energy Resources Research Fund project 18. Helium recovery from natural gases. Part 4. Helium reserves in Alberta.** (Alberta Helium Ltd., Calgary (Canada)). [1982]. 7p. (CE—01900). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A summary is presented of the reserves of natural gas in Alberta with a helium to natural gas ratio of l0.0010 or greater. The summary shows that the gas reserves with the highest concentrations are in the Fox Creek, Peace River and Alderson (South Eastern Alberta) areas. It also shows the gas reserves and helium content in these higher helium concentrations pools which would be left in 1985 at the projected rates of production. 1985 was considered the earliest date by which a helium recovery plant could be completed if such a plant was found to be economically feasible. If all the gas with the higher helium concentrations in each of the areas discussed above could be collected and processed at a single plant, it is shown that there would be sufficient gas in each of the Fox Creek and Alderson areas to support a million cubic metres per year plant at a 60% recovery factor. An appendix presents a description and tabulation of the helium content of Alberta's raw gas at 31 December 1981, showing that at the year-end Albert's remaining established natural gas reserves contained 931 million cubic metres of helium. 1 fig., 3 tabs.

56126 **(AHL—7906) Helium in Alberta.** (Alberta Helium Ltd., Calgary (Canada)). Jun 1979. 45p. (CE—01902). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Helium is found in small quantities in natural gas in Alberta and most natural gases throughout the world. This report outlines its properties and its present day uses such as the space program, welding of metals, controlled atmospheres for growing crystals for semi-conductors, chromatography, heat transfer, leak-testing, and research and medical-biological applications. It also appears that liquid helium will be necessary to provide a practical source of the low temperature necessary for the many potential applications of superconductivity. These offer many possibilities for savings in energy-related applications. This report also examines helium supply and demand in the USA, the principal source of supply to the Western world, Japan, which must import all its requirements, and Canada. Since the failure of Canadian Helium's Saskatchewan plant in 1977, Canada has no indigenous supply and no apparent sources which are viable under current technology. Alberta had 33.1 billion feet/sup 3/ of helium as of December 31, 1977 contained in its proved reserves of natural gas. None of this is economically recoverable under current commercial technology. By 1985, when a commercial plant would come on stream, 72% of the ultimate reserve of 47 Bcf will still be available. Alberta now has a process being field-tested which has an energy requirement only 25-30% of that of the presently available method. Should the test be successful, it will make possible the economic recovery of helium from the province's pipeline gases and the sale of the technology to other countries. 17 refs., 4 figs., 1 tab.

56127 **(AHL—8104) The permeation process for the recovery of helium from natural gas.** (Alberta Helium Ltd., Calgary (Canada)). Jan 1982. 26p. (CE—01937). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Research and pilot plant operation have proved the technical aspects of a permeation process suitable for helium recovery from natural gas containing 0.05 vol% helium or more. The process is much less energy intensive than the established cryogenic process. A conceptual commercial plant design indicates extraction may be done at costs which would be competitive with the costs of plants using the cryogenic process on richer gases. Commercialization of this process is being sought. This paper outlines the uses of helium, and reviews the state of the helium industry and markets in Canada, Alberta, the USA, Japan, and Europe. Assessment is made of the cryogenic process and the permeation process. This process uses stages involving compression and passage through membranes, with drying, scrubbing, and other purification stages. Energy requirements and economics of the process are also summarized. 11 refs., 8 figs., 1 tab.

56128 **(AHL—8202) Energy Resources Research Fund project 18. Helium recovery from natural gases. Part 1.** Welch,R.V. (Alberta Helium Ltd., Calgary (Canada)). Feb 1982. 11p. (CE—01903). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report summarizes a series of reports or a project intended to develop the helium production capability of Alberta. The project involved investigating helium reserves and markets, development of a method for extraction of helium from natural gas and of a pilot plant to demonstrate the process, and performing economic evaluation and forecasting. The technical feasibility of using a membrane permeation process for helium extraction has been determined, and pilot plant operation has generated the data for design of a commercial-scale plant. The process has an energy requirement of ca. 40% of that of the conventional cryogenic process. Forecasts of markets and costs indicate a viable future for this process. 1 tab.

0305 Health And Safety

REFER ALSO TO CITATION(S) 57261, 57263, 57264, 57265

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 56097, 56140

56129 (CGA—8705, pp 6-21) **Deregulation of the gas industry in Canada.** Walker, R.D. (Canadian Gas Assoc.; Trans Canada Pipelines). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

This presentation discusses the changing environment in which the Canadian gas industry is operating. This environment is characterized in one aspect by an overlapping set of jurisdictions that regulate the industry, and within recent years, changes in the regulatory environment have tended toward transferring to the buyers and sellers the responsibility for negotiating prices. Vestiges of older, more interventionist policies still remain, one of which is an oversupply of gas. Future developments in the supply and demand situation are forecast, one being an increase in demand in the USA without a corresponding increase in deliverability of gas from Canada. This will require harmonization of US and Canadian policies on energy, regulation and trade, and private sector plans are being made for ways to react in advance to this situation so that government intervention is minimized.

56130 **(DOE/EIA—0130(88/07)) Natural gas monthly, July 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 30 Sep 1988. 159p. NTIS, PC A08/MF A01 - GPO. Order Number DE89001013/JAW.

The NGM (Natural Gas Monthly) highlights activities, events, and analyses of interest to public and private sector organizations associated with the natural gas industry. Volume and price data are presented each month for natural gas production, distribution, consumption, and interstate pipeline activities. Producer related activities and underground storage data are also reported. From time to time, the NGM features articles designed to assist readers in using and interpreting the natural gas information. The data in this publication are collected on surveys conducted by the EIA to fulfill

its responsibilities for gathering and reporting energy data. Some of the data are collected under the authority of the Federal Energy Regulatory Commission (FERC), an independent commission within the DOE, which has jurisdiction primarily in the regulation of electric utilities and the interstate natural gas industry. 11 figs., 49 tabs.

56131 **(LU—0936) Diffusion of natural gas in Quebec's residential sector.** Zins, M. (Laval Univ., Quebec City (Canada)). Mar 1983. 153p. (In French). (CE—01936). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report is an analysis of the present state of the introduction of natural gas as an energy source in the single-family residential sector of Quebec. It presents the attitudes of householders using oil, or recently converted to natural gas, to this new (for Quebec) energy source. The research is intended to: review the state of applied research in the field of diffusion and commercialization of innovations in energy, particularly natural gas; measure the structure of attitudes and perceptions of those faced with natural gas as a new energy source; identify the factors influencing the penetration of natural gas as an alternate energy source; segment the population as a function of their disposition to adopt natural gas and the factors which determine this disposition; identify the process of diffusion of natural gas as an energy source in households; evaluate the possiblity of developing an individual model of forecasing the adoption of natural gas; and develop the basis for an aggregate model of the diffusion of natural gas as an energy source. Among the major findings were the following. Natural gas has started penetrating the Quebec market, and different attitudes have been seen in different regions. The level of knowledge and understanding of natural gas is on a low level. There is a perception of gas having a lack of safety. Users of gas have a good perception of the product and are satisfied with its use. Information sources perceived as credible are mainly consumer-protection organisations and the government energy ministry. 7 figs., 27 tabs.

56132 **(PB—88-236260/XAB) Outlook for natural gas in the industrial sector. Topical report.** Lerner, M.O.; Salama, S.S.; Hogan, T.C. (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Jan 1988. 80p. NTIS, PC A05/MF A01.

See also PB—88-236278.

The study provides information on industrial energy use, detailed by technology, functional end-use, industry, and region. The main objective of the study was to identify and discuss the salient trends in future industrial energy and natural gas use in the 1987 GRI Baseline Projection and analyze the basic factors underlying those trends. Appendices include a comparison of industrial energy-demand projections, a discussion of the technical feasibility of fuel substitution in industrial combustors, and input assumptions used for regional production growth rate and fuel price projections.

56133 **(PB—88-236278/XAB) Outlook for natural gas in the industrial sector (Executive Summary).** (Gas Research Inst., Washington, DC (USA). Strategic Analysis and Energy Forecasting Div.). Jan 1987. 13p. (GRI—88/0189.2). NTIS, PC A03/MF A01.

See also PB—88-236260.

A study conducted by Energy and Environmental Analysis, Inc. provided information on industrial energy use, detailed by technology, functional end-use, industry and region. The findings and conclusions of the study report (GRI-88/0189.1) are summarized. The main objective of the study was to identify and discuss the salient trends in future industrial energy and natural gas use in the 1987 GRI Baseline Projection and analyze the basic factors underlying those trends.

56134 **(PB—88-240882/XAB) Gas appliance technology center: 1986 annual report (activity at Institute of Gas Technology). Report for January-December 1986.** Zawacki, T.S.; Ketels, P.A.; Jasionowski, W.; Kardas, A. (Institute of Gas Technology, Chicago, IL (USA)). Jul 1988. 49p. NTIS, PC A03/MF A01.

See also PB—88-163373.

This report contains the results of two investigations conducted as part of the Gas Appliance Technology Center for 1986. Specifically, Development of a Natural-Gas-Fired Low-NOx Burner, and a Techno-economic Feasibility Study of Task-Specific Water Heating for Residential Applications. In the first task, a two-stage, swirl-type, natural-gas fired combustor with low NOx emissions potential, was designed, fabricated, and tested. In the second task a techno-economic study of providing hot water for a bath/shower in a domestic application, using an instantaneous or task-specific water heater, was performed. The study included a survey of currently available instantaneous water heaters, determination of life-cycle costs for domestic applications, potential for unconventional venting through plumbing stacks and a review of national, state, and local plumbing codes for possible restrictions on venting.

0307 Waste Management

REFER ALSO TO CITATION(S) 56102, 56103, 56104, 56105, 56106, 56107, 56108, 56110

0308 Environmental Aspects

REFER ALSO TO CITATION(S) 56110, 56112, 56113, 56114

56135 (ASPB—8404, pp 37-48) **Hanlan Robb Sour Gas Plant: mitigation and public participation.** Wright, M. (Gulf Canada Resources, Inc., Calagary, Alta.). [1988]. Alberta Society of Professional Biologist, P.O. Box 566, Edmonton, Alta., Canada T5J 2K8; $15.00 CAN; MFCANMET/TID, Energy, Mines and Resources, CAN, 555 Booth St., Ottawa Ont., CAN K1A 0G1; $10 CAN. (CONF-8404344—; MICROLOG—88-00214).

From Symposium on environmental mitigation: solutions to problems; Edmonton, Canada (24 Apr 1984).

This paper deals with the actions taken to correct or lessen impacts associated with the pre-construction, construction and operations phases of certain sour gas processing plants in Alberta. Most of the paper discusses the Hanlan Robb Plant, processing 300 million cubic feet per day since 1983. Potential impacts were addressed with studies completed in 1981. Public participation processes enabled identification of social issues that would require mitigation, such as employment opportunities, and effects on local logging, trapping, and recreation activity. From a biophysical perspective, the principal focus of mitigation was on water quality and fish habitat, since the plant area is noted for its trout-containing surface waters. Much of the mitigation work concerned preventing effects on streams during pipeline construction. Operational aspects of mitigation were mainly concerned with sulfur handling. Environmental effects of sulfur transport have been minimized by using prilling processes to achieve a stable, relatively dust-free form of sulfur suitable for transport, and by special leak-minimizing procedures used for breaking up sulfur blocks.

0309 Artificial Stimulation

56136 **(DOE/MC/21119—2548-Vol.1) Stimulation model for lenticular sands: Volume 1: Final report.** Rybicki, E.F.; Luiskutty, C.T.; Sutrick, J.S.; Palmer, I.D.; Shah, G.H.; Tomutsa, L. (Tulsa Univ., OK (USA)). Jul 1987. Contract AC21-84MC21119. 379p. NTIS, PC A17/MF A01. Order Number DE88001045/JAW.

This research is part of a larger program sponsored by the United States Department of Energy with the objective of developing better methods to produce gas from low permeability formations in western gas sands. This large research program involves several universities and research centers. Each group is involved in a different area of study to answer specific questions. The hydraulic fracturing computer model has three components---a model for fracture geometry, a model for proppant transport, and a computer program that couples the two models. The fracture geometry model was developed at Oral Roberts University and the proppant transport model was developed at The University of Tulsa prior to the start of the present work. The present work is directed at enhancing the capabilities of these two models and coupling them to

obtain a single model for evaluating the final fracture geometry and proppant distribution within the fracture. The report is organized into four parts. Part 1 describes the fracture geometry modeling effort accomplished at Oral Roberts University, NIPER and recently at The University of Tulsa. The proppant transport model, developed for constant height fractures at the University of Tulsa, is contained in Part 2. The coupling of the Proppant Transport Model and the model for the variable height fracture geometry constitutes Part 3 of this report. Part 4 presents a summary of accomplishments and recommendations of this study. 112 refs., 147 figs., 70 tabs.

56137 **(PB—88-231717/XAB) Review of the mechanisms of gas outbursts in coal. Information Circular/1987.** Hyman, D.M. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1987. 18p. (BM-IC—9155). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600180.

Outbursts are sudden and violent releases of gas and coal that result from a complex function of geology, stress regime, and gas pressure and content. Outburst-prone coal may be distinguished from normal coal by its sorption-desorption velocity. Three types of methods used to characterize the kinetics of sorption-desorption are described; all are based on the ability of outburst-prone coal to release, through desorption, methane or carbon dioxide much more rapidly than normal coals. Other prediction methods, based on borehole samples, are also described. Various mitigation methods are described and evaluated.

56138 **(PB—88-245725/XAB) Brine chemistry and control of adverse chemical reactions with natural gas production. Final report, January 1986-February 1988.** Street, E.H.; Cuddihee, J.L.; O'Day, P.; Salimi, M.H.; Tomson, M.B. (Rice Engineering Design and Development Inst., Houston, TX (USA)). Feb 1988. 145p. NTIS, PC A07/MF A01.

See also PB—88-118245.

The solubilities of the various alkaline earth salts of the most commonly used phosphonic acid scale inhibitors have been determined in the laboratory. Additional work done on laboratory simulation of inhibitor squeeze indicates that the inhibitor adsorbs uniformly on the reservoir rock rather than being selectively adsorbed on certain mineral species. Work on the synthesis of pure ferrous carbonate has been continued. Ferrous carbonate is reported in the corrosion literature to occur occassionaly as an adherent dense precipitate on steel surfaces. Future laboratory and field work will be directed. Two producing wells in the East Hitchcock Gas Field have been equipped with two external treat strings each.

0310 Legislation And Regulation

REFER ALSO TO CITATION(S) 56768

56139 **(AEC—8802) Resolving conflict. A case study.** Lilley, J. (Environment Council of Alberta, Edmonton (Canada)). Feb 1988. 24p. (MICROLOG—88-02832). Environment Council of Alberta, 8th Floor, Weber Centre, 5555 Calgary Trail, Edmonton, Alta., CAN T6H 5P9; $N/C; MF CANMET/TID, Energy, Mines and Res. CAN, 555 Booth St.,Ottawa, Ont., CAN K1A 0G1.

Alternative conflict resolution, an approach that encompasses negotiation and mediation as means of resolving conflicts in a non-adversarial manner, is illustrated using an example from Alberta. An application was made for a license to construct a small but controversial sour gas processing plant. After initial local opposition, subsequent events led to successful negotiations of an agreement between the company and community organizations. The paper then considers alternative conflict resolution in the context of developing and implementing the Alberta Conservation Strategy, one goal of which is to identify areas of interaction and potential conflict among resource users, and to provide opportunities for discussion and resolution of these conflicts. Application of the principles of alternative conflict resolution reveals present weaknesses in Alberta's system for incorporating negotiation into resource management plans. More examples of successful alternative conflict resolutions are needed before it becomes a fully accepted option. 12 refs.

56140 **(MPUB—112/88) Public hearing to consider the availability of transportation service on Greater Winnipeg Gas Company and ICG Utilities (Manitoba) Ltd. distribution systems to review the existing buy/sell arrangement criteria and to review other related matters.** (Manitoba Public Utilities Board, Winnipeg (Canada)). Jul 1988. 85p. (CE—01943). Manitoba Public Utilities Board, 405 Broadway Ave., Rm. 1146, Winnipeg, Man., Canada R3C 3L6; $N/C.

A public hearing was held before the Manitoba Public Utilities Board to consider an application to provide transportation service (T-service) on gas distribution systems, for approval of proposed firm and interruptible T-service rates, for confirmation of certain Interim Ex Parte Orders, and for implementation of certain metric billing criteria for gas sold volumetrically. The hearing addressed a number of issues, including: types of T-service, T-service rates, and the Board's jurisdiction over, and the role of, brokers; diversions and multiple delivery points; buy/sell criteria including existing contracts, prices and load balancing; and administration fees, telemetry, backstopping, unaccounted-for gas, public access to information, the direct purchaser's impact on rates, priority of service, and the Natural Gas Supply Act/Order-in-Council 999/87. After considering evidence and testimony by the companies involved and various intervenors, the Board concluded that T-service should be made available. Pending a rate base, rate of return hearing and completion of the companies' ongoing cost of service study, the Board is satisfied that T-service should be made available to Manitoba natural gas consumers and that the proposed T-service rates should be approved. The Board also ordered that the proposed T-service incorporate certain conditions, that buy/sell arrangements as amended continue to be made available, and that the companies take such actions as may be necessary to conform with the Electricity and Natural Gas Act. A number of Interim Ex Parte Orders were confirmed.

56141 **(MPUB—113/88) Public hearing to consider the availability of transportation service on Greater Winnipeg Gas Company and ICG Utilities (Manitoba) Ltd. distribution systems to review the existing buy/sell arrangement criteria and to review other related matters. Order 113/88.** (Manitoba Public Utilities Board, Winnipeg (Canada)). Jul 1988. 4p. (CE—01949). Manitoba Public Utilities Board, 405 Broadway Ave., Rm. 1146, Winnipeg, Man., Canada R3C 3L6; $5.00 CAN.

This Order is complementary to previous Order 112/88 dealing with the provision of transportation service and buy/sell arrangements on natural gas distribution networks. This Order relates specifically to brokers and their role in gas transactions. It requires that all persons selling, delivering, purchasing directly, storing, or transmitting gas within Manitoba shall obtain an order from the Public Utilities Board of the province authorizing such behavior.

0320 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 56121, 56122

56142 (CGA—8705, pp 416-421) **Data acquisition for the gas industry.** Knazko, J. (Romat Ltd.). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8.00 CAN. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

This paper describes a data acquisition system for use in natural gas distribution. It monitors, calculates, processes, displays, or transmits data on pressure, temperature, gas flow, time, volume, alarms, and factors such as specific gravity, nitrogen and carbon dioxide content, and supercompressibility. It obtains data from electronically corrected gas meters and electronic volume correctors, which can be up to 300 ft away from the data collection and processing unit. Data can be accessed via keyboard, data retrieval terminal, or telephone link. Options include communications and software packages and multiple-input and control modules.

56143 (CGA—8705, pp 477-482) **Effective use of deadweight testers.** Morrison, M. (E.G & G. Chandler Engineering). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8.00 CAN. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

This paper discusses the proper use and application of deadweight testers as used in the gas industry. Deadweight gages are the most accurate instruments available for measuring pressures, and are easy to use and transport, with minimum maintenance requirements. Applications also include calibration and testing. Operating requirements and measurement principles are listed; accuracy is typically 0.02% or better with high sensitivity. Operation of hydraulic deadweight gages is also described. Hydraulic deadweight testers, consisting of a deadweight gage plus a self-contained pump, can be used as pressure gages, in calibrating other less accurate pressure measuring devices, such as transducers, and in the hydrostatic testing of pipelines. Pneumatic deadweight testers are high accuracy pressure regulators, and operating procedures for hydraulic and pneumatic testers are given.

56144 (CGA—8705, pp 522-534) **Turbine meters and electronic volume correctors.** Blanchard, E. (Cooper-Chapman Ltd.). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8.00 CAN. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

Turbine meters are used in natural gas distribution systems to provide accurate and reliable measurement of gas volumes for billing and other purposes. This paper describes the principles and the operation of such meters. Capabilities of various sizes of meters are listed, calibration and lubrication is outlined, reliability is assessed along with ways to avoid reliability problems and increase service life, and the kinds of outputs available from meters are outlined. It is felt that turbine meters are highly accurate, reliable and repeatable, compared to other gas meters, and are capable of measuring a wide range of flows. A large number of output options, including mechanical and electrical, provide flexibility in use. Electronic volume correctors are also described; such units are designed to be used in installations where accurate volume correction from line conditions to base volume is required. Current models have advantages including ease of operation, safety, and simple checking and calibration. 13 figs., 1 tab.

56145 (CGA—8705, pp 500-502) **Turbine meter testing system.** Ethier, R. (Rockwell International). 1987. (In French). Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8.00 CAN. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

This paper describes testing facilities of Rockwell International for testing gas meters, including bell provers, standard meters used for comparison with the meter being tested, and automatic computer-based testing systems. A Montreal gas utility has expressed interest in installing a computer controlled prover system which would detect the degree of rotation of the meter output shaft. Such a system including a Hewlett Packard computer, pressure transmitter, and oscilloscope, has been installed and is functioning properly.

56146 (CGA—8705, pp 483-498) **Smart transmitter technology.** Johnson, A. (Rosemount Instruments Ltd.). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8.00 CAN. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

This paper discusses data transmitting devices used in conjunction with gas meters, and how to evaluate them for gas utility applications. The transmitters considered in this paper are microprocessor based, may exhibit higher accuracy or performance than their analog counterparts, perform continuous diagnostics, have the ability to communicate, and can be configured remotely. Specific features of a particular transmitter are largely determined by the nature of the microprocessor. Transmitter performance can be improved by the microprocessor's ability to make corrections to output through data it receives from sensors and through calculations that condition sensor output. In addition to performance, the communications capability can be different from one instrument to another because of the communications technique employed. There is no single standard for communication, so the user will have to consider such factors as compatibility and whether or not to use digital signals. Advantages of digital communications schemes include immediate fault notification, on-line diagnostics and record-keeping, better performance, and configuration capability; disadvantages include a decrease in speed and increased cost. Selecting the right transmitter involves considering criteria based on the application involved; such criteria include the degree of functionality required by the application, the flexibility of implementation of the system, and compatibility with present and possible future systems. 4 figs.

56147 (CGA—8705, pp 441-476) **Advance gas meter proving system.** Fisher, H.W. (Rockwell International). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8.00 CAN. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

The emphasis in metering over the past decade or more has been concentrated on achieving higher accuracies in the measurement of natural gas. Several advanced proving systems resulting from efforts addressing this industry desire are presented in this paper. These systems are directed toward the needs and peculiarities of proving both low flow (domestic) and high flow (transmission and distribution) metering equipment. Specific items discussed are: the laboratory piston prover, designed to determine volume to within 0.01% or better; updated production calibration equipment, which adapt improved control technologies developed on the piston prover to the older bell prover; a transfer standard for dual rotary meters; replacement of original transfer standard turbine meters with 'smart' turbine meters that continually check their calibration while in service; and an auto-adjust prover for field use. Test facilities at which these developments occurred are also described. 30 figs., 2 tabs.

56148 (CGA—8705, pp 422-440) **ELSA - a new approach to electronic volume correction.** Barnett, B. (Canadian Meter). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8.00 CAN. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

This paper describes a digital electronic flow computer developed specifically to operate in gas transmission and distribution systems with diaphragm, rotary, and turbine meters. It is a microprocessor-based system programmed to solve the equations for meter volume, corrected to base conditions, with an accuracy not obtainable from mechanical correctors or integrated chart recordings. Diagnostic routines are incorporated in the computer program to reduce the time required to verify or adjust unit calibration. Other features that go beyond the capability of current mechanical correctors include automatic alarm indicator, bidirectional volume counting, and pulse output to remote counters. It is battery powered and self-contained in a tamper resistant case. A remote repeater is an optional extra. Operation of the system and its components is detailed. 7 figs., 3 tabs.

56149 (CGA—8705, pp 398-404) **Bar code system for meter shop purposes.** Rankin, D. (B.C. Hydro, Gas Operations). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8.00 CAN. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

Bar codes, widely used in a variety of industrial and commercial applications, have found another new application in gas meter shops associated with a British Columbia gas utility. The codes contain the meter identification and serial numbers, the dial reading and whether it is a new or reworked meter. The bar codes

are produced when the meter is booked into the shop and stay on the meters as they go through the various shop procedures. When meters are booked out of the shop, the data stored in them are read out and transmitted to the utility's computer system. The bar code system enables fast, accurate and timely data entry and requires less paperwork. Other applications for bar codes in the utility include employee tracking, tool tracking, and inventory control.

56150 (CGA—8705, pp 380-397) **New meter-reading technology for improved customer service.** Giguere, G. (Gaz Metropolitain). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8.00 CAN. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

This paper describes an automated route design and management system (ARDMS) used for gas utility meter reading analysis and management. It is a computer system designed to assist utilities in evaluating and managing their meter reading functions effectively. It is specifically intended to do such things as develop meter reading routes automatically, determine how many meters should be on a given route, and adjust route size according to changing conditions. Implementation of this system at a Quebec gas utility is summarized. The system has been found to provide the utility with a complete route design methodology, a rerouting of the old system into efficiently planned meter reading routes, a reduction in the number of meter readers required, and enhanced management control and performance measurement. Recommendations are made to prospective users of an ARDMS system.

56151 (CGA—8705, pp 284-300) **Fundamentals of energy measurement.** Hanowich, P. (Rockwell International). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8.00 CAN. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

Measurement of the energy content of natural gas is becoming increasingly important to gas users. This paper describes the principles and techniques of measuring the Btu content of gas by chromatography. Illustrations are presented showing how the use of helium flushing separates the components of natural gas into separate streams according to the size and mass of the molecules involved. The backflush to measure technique is also described, showing how it improves resolution of the heavier components. A chromatographic gas analysis system is then detailed. This has four subassemblies, the gas line sampling tap, the analyzer, the control module and the operator keypad. The analyzer as described in this paper consists of a sample manifold, a chromatograph and an interface module, and is capable of analyzing sixteen different streams automatically. The control module includes a calculation unit, memory, tables, method storage, communications, and various data readout functions, and is designed for automatic, unattended operation. Complete control of the system is through the operator keypad, and numerous reports can be generated through a built-in printer. The system can be combined with an orifice meter flow computer to give the ability to acquire flow data and produce reports on total gas energy. 23 figs.

56152 (CGA—8705, pp 273-283) **New charts integrator/orifice metering.** Johnson, M. (BMP Chart Service Ltd.). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8.00 CAN. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

This paper describes the basic principles of operation of orifice-type gas meters and their corresponding chart recorders. Chart processing and interpretation is also discussed with a view of indicating areas where volume interpretation errors may occur. Means for volume calculation are briefly described, including mechanical and electronic integrators, planimeters, and electronic measurement devices. Typical chart errors detailed in this paper include calibration errors, errors in identification, temperature error, orifice size and line size errors, incomplete chart traces, bent pens, vibration and spiking, and using a chart with the wrong cycle. 2 figs., 1 tab.

56153 (CGA—8705, pp 254-272) **The computerized meter shop from prover to mainframe.** Ward, S. (Inland Natural Gas Co. Ltd.). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8.00 CAN. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

This paper describes the application of a personal computer to the control of meter movements in a gas meter shop. A system has been developed to keep track of such data as meter identification numbers, verify various stages of the test process, store test data, perform statistical analyses, compile and print audit reports, and transmit information to a mainframe. Use of this system in an Ontario gas utility as part of a larger mainframe computer control system has proved to be very successful, showing improvements in record accuracy and operational productivity as compared to the previous handwritten card systems. 12 figs.

56154 (CGA—8705, pp 235-239) **EPT electronic correctors and systems.** Ensch, R. (Dresser Canada, Inc.). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8.00 CAN. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

Electronic volume correctors as used in natural gas metering fall into two basic types. Volume correctors which are integrally part of a gas meter are used where it is necessary to have a dedicated instrument for each meter. Correctors located remotely from the metering device are usually a more complex installation but can provide data logging capabilities such as volume, average daily pressure, temperature, and flow rate. This paper discusses aspects of electronic correctors and systems that have to be understood for their proper use. One problem area is performance specifications, which have to be properly understood to know how they affect a metering application. A list of definitions of possible specifications is presented. Calibration, testing, and maintenance procedures are equally important in evaluating which correctors to use. Power sources can vary between different correctors and an understanding of the limitations of such sources is important in a successful operation; these sources include batteries, line power, and solar cells. Finally, safety of operation is a concern, but this is minimized in currently available electronic instruments because they are designed to be intrinsically incapable of causing ignition of gas during normal or abnormal usage.

56155 (CGA—8705, pp 228-234) **Gas measurement by insertion turbine flow meters.** Blanchard, E. (Cooper-Chapman Ltd.). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8.00 CAN. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

This paper presents a review of insertion turbine meters as used by the gas industry to measure gas flows in a variety of non-custody transfer applications. Such applications require a gas flow measurement apparatus that meets such criteria as ease of installation, accuracy, removability, reliability, and simplicity. The theory of insertion turbine meters is presented, including analysis of flow in pipes, in order to show how location and size of the turbine affect the measurement process. Details are given of the ISM-68 turbine meter module, insertion mechanism, and pressure housing, and some applications are suggested. 10 figs., 3 tabs.

56156 (CGA—8705, pp 191-205) **Union Gas experiences with Metretek System.** Kent, D.W. (Measurement Engineering). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8.00 CAN. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

This paper describes an Ontario gas utility's experience with a system providing a means of electronically recording, transmitting and analyzing data from gas meters. It is a computerized replacement for a charted meter system and is faster, more reliable, and more accurate than traditional technology. It uses a microprocessor

for coulting and storing time-tagged pulse data, with alarm capability, a telecommunications link, and a central computer that controls the operation of the remote microprocessors, collects the data gathered and calculates corrected gas volumes as well as performing a number of other functions. The system is used for monitoring consumption and providing billing information for the utility's large customers, which account for 60% of the utility's gas volume from only 50 gas meters.

56157 (CGA—8705, pp 161-190) **New application of axial flow valves.** Poole, J. (Canadian Meter). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8.00 CAN. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

This paper documents the additions, modifications, and alternatives which have resulted in a broadening of the applications of axial flow valves in natural gas distribution systems. Typical past application was as a reguator or relief valve. One new application is the introduction of flow restricting capability for reasons of safety and conservation; this is done by mounting the appropriate restrictor trim kit on the valve. Another development is the appearance of new sleeves and control loops to make the valves useable in low pressure applications. Investigation into the operation of valves at higher pressures has shown an increased pressure required to open the sleeve, the effect of which is to overstate the capacity at high inlet. A new pilot control loop was designed which reduced the pressure required to open the valve. This loop is applied in a venturi used in stations to control line pack. This new loop design improves pilot sensitivity, reduces outlet pressure drop, and improves control. Because of the options of sleeve and pilot loops available, and the need to assess these options quickly and accurately, a software package has been developed to enable users to perfom calculations for all sizes, ratings, sleeves and pilot loops; sample outputs from programs in this package are presented. Also included in this report is a checklist of items to consider when a capacity problem is reported. 15 figs., 2 tabs.

56158 (CGA—8705, pp 154-160) **The basics of pressure pulse proving.** Follin, S. (Sprague Schlumberger). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8.00 CAN. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

This paper discusses the theory and practical application of pressure pulse proving equipment to the gas meter shop operation. This type of equipment compares a known volume of displaced gas to a number of meter cycles and then automatically calculates and displays an accuracy statement about the meter. It is capable of performing a number of different tests, including differential pressure and leak tests, using only one run of the bell, therefore demonstrating superior speed, versatility and reliability. Details of operating the prover in a typical test cycle are presented. 2 figs.

56159 (CGA—8705, pp 128-147) **Development and testing of the domestic regulator vent shield.** Hinchley, P.; Donkin, B.; Rozycki, B. (Consumers Gas Co.). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8.00 CAN. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

This paper presents research into the development of a vent shield for a gas pressure regulator as used in natural gas distribution to residential customers. Problems with currently used relief vents include freezing over of the vent opening in the winter, and dirt or other obstructions on the relief valve seat. A vent shield design had to be developed that would protect the vent from water and to limit the amount of break-open pressure in case the vent did freeze over. It also had to be compatible with existing meter sets, economical, maintenance-free, and with a long service life. Fourteen prototype shields were tested, and extensive field tests were conducted on the approved version. The test program included testing of freezeover resistance, pressure required to break an ice seal, effect on regulator relief capacity and regulator operation, quality of the seal of the joint between the shield and the vent opening, resistance to impact, and compatibility with existing regulator sets. Ten thousand shields were installed in the winters of 1984 and 1985, and 45,000 in 1986, with no failures associated with a vent shield.

56160 (CGA—8705, pp 113-127) **New regulator technology 399.** Irwin, D.W. (Fisher Controls International). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8.00 CAN. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

This paper describes developments in improved gas pressure regulators developed by Fisher Controls. The Model 399 uses a globe style valve body, with ease of maintenance and construction, incorporating a fabric reinforced elastomeric boot, a moving diaphragm support, and a new pilot system available in several configurations. The boot is specially designed to prevent gas bubble formation and consequent diaphragm failure. The basic regulator construction can also be used as a relief valve by a simple change of pilot. The Model 627 high pressure regulator is provided in four different configurations in various sizes, again designed for simplicity and reliability, with the possibility of including relief valves. 20 figs.

56161 (CGA—8705, pp 102-106) **New Mercor-EC electronic corrector.** Holmes, J. (Mercury Instruments, Inc.). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8.00 CAN. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

This paper describes the Mercor EC, a microprocessor-based volume corrector which is installed on a gas meter. It includes pressure and temperature sensors, digital data display and entry, and communications capability. It operates in four separate modes to provide reliable and accurate volume correction while providing different levels of access. Most of the time it would operate in the corrector mode, displaying corrected gas volume continuously. Other modes are for reading the meter, calibration, and configurating the meter in the meter shop. Advantages of using this device include improved accuracy, flexibility for operation in a variety of conditions, and fast communication of meter data.

56162 (CGA—8705, pp 62-93) **Electonics technology with communications.** Sweeney, G. (Metretek, Inc.). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8.00 CAN. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

This paper describes electronic systems for the remote collection of natural gas distribution system data, and some potential applications for this technology. Advantages of such systems in industrial load monitoring include: ability to read and bill the same day; faster response to failures at the metering site; accuracy of measurement with fine resolution; and reduction in the amount of gas unaccounted for. In residential meter reading, electronic remote monitoring enables low cost reading of accounts where access to the meter is difficult. Two basic collection methods are real-time and on-command. Most data needed by utilities is gathered by request or on a scheduled basis, and on-command systems can supply these data very economically. These include systems incorporating microprocessors and sensors and connected to telephone lines, reporting data only on request, according to a schedule, or in case of emergency.

56163 (CGA—8705, pp 62-93) **Quality acceptance program for regulator stations.** Lapp, D. (Consumers Gas Company). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8.00 CAN. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

This document describes the program used at an Ontario gas utility for quality evaluation at its gas regulator stations. The pro-

gram consists of evaluating how the company's operating procedures with respect to quality are being carried out, reporting the results of the evaluations, and making recommendations for remedial action if necessary. The objective is to ensure that the quality of existing facilities is maintained to the desired standards and specifications. General aspects of the program include selection of verification staff and choosing appropriate sampling procedures. Facilities are classified into three main categories: gate stations, where gas is accepted from a transmission company's metering station; district stations, where the gas flow is regulated from a higher to a lower pressure pipeline system; and sales stations, where gas from any pipeline system is delivered to a customer. Each station's faults are noted in the areas of customer and employee safety, technical procedures, paperwork, and housekeeping. Specific potential problems in each of these areas are summarized for each station type and each fault category. 3 figs., 2 tabs.

56164 (CGA—8705, pp 22-34) **Electronic instrument vs mechanical instrument.** Hanowich, P.J. (Rockwell International Corp.). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

Gas volume measurement in natural gas distribution systems is done by meters that measure gas at base values of temperature and pressure. Any variance from these parameters requires a calculation to correct the gas line volume to the base volume. A number of ways have been evolved by the industry to obtain this base volume, including meter-mounted mechanical instruments. This report describes meter-mounted electronic instruments that contain digital computational circuits capable of handling virtually any measurement condition. The specific instruments whose operation is detailed in this document are called Electrocorectors, which obtain volume input from the meter's mechanical output shaft, temperature input from a transducer, and pressure input from a transducer connected by a capillary tube to a pressure tap on the meter. Three versions of the Electrocorector are described. Some versions have communications capability for data transmission via phone lines. Overall advantages of these instruments include accuracy, ease of calibration and installation, safe operation, and flexibility in their performance of data collection and their ability to develop reports to suit individual requirements. 12 figs.

56165 **(PB—88-222393/XAB) Mojave-Kern River-El Dorado natural gas pipeline projects, Final Environmental Impact Report/Statement. Volume 1. Mojave, El Dorado, El Paso, and Transwestern. Volume 2. Kern River. Volume 3. Comparisons and recommendations. Volume 4. Maps. Volume 5. Letters and comments. Report for April 1985-December 1987.** (Federal Energy Regulatory Commission, Washington, DC (USA). Office of Pipeline and Producer Regulation). Dec 1987. 2557p. (FERC/FEIS—0045). NTIS, PC A99/MF E16.

The Federal Energy Regulatory Commission (FERC) and the California State Lands Commission (SLC) have jointly prepared a final environmental impact statement (EIS) for projects proposed by Mojave Pipeline Company and Kern River Gas Transmission Company. These primary projects are competing to transport natural gas from sources outside California to the Bakersfield, California area for use in enhanced-oil-recovery projects. In each case, producers of crude oil in the San Joaquin Valley would use the natural gas as boiler fuel to create steam, which would then be injected into the oil fields to produce crude oil not recoverable by primary recovery methods. Some of the steam would be used to generate electricity. The FEIS was prepared under the direction of the FERC and SLC staffs to satisfy the requirements of the National Environmental Policy Act and the California Environmental Quality Act.

0330 Properties

REFER ALSO TO CITATION(S) 56151

56166 (CGA—8705, pp 405-415) **Continuous measurement of natural gas components.** Howard, D. (Foothills Industrial Products Ltd.). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills, Ont., Canada M3B 2R3; $8.00 CAN. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

This paper describes the PMI GB-3000 Therm-Titrator, a device used for continously measuring the heating value, specific gravity, carbon dioxide content, and nitrogen content of natural gas. The instrument uses a stoichiometric combustion method of measuring heating value. A gravitometer using the porous flow method measures the relative density. An infrared absorption analyzer is used to make the carbon dioxide measurement, and the nitrogen content is determined by a software program. The theory and operation of each component of the GB-3000 is explained. Requirements for installation, power supply, air supply, gas supply, and calibration are outlined. This system enables a complete computation of energy content in natural gas to be made as frequently as desireable without the inaccuracy introduced via the use of average factors. 3 figs.

56167 (CGA—8705, pp 42-61) **Computerized supercompressibility factor calculations for operation purposes.** Gagnon, P. (Gaz Metropolitain, Inc.). 1987. Canadian Gas Association, 55 Scarsdale Road, Don Mills., Ont., Canada M3B 2R3; $8. (CONF-8705317—; CE—01895).

From 6. annual gas measurement school; Quebec City, Canada (26 May 1987).

This paper presents the basic theory of gas compressibility and gives the methods for calculating the supercompressibility factor for natural gas. Examples are given from calculations using empirical methods with input data taken from the Groupe Europeeen de Recherches Gazieres data bank. Brief discussions are presented of the effect on gas metering using the supercompressibility factor in volume calculations, and of possible applications including instrument calibration, turbine metering, and orifice metering. 2 figs., 2 tabs.

56168 **(PB—88-232228/XAB) Analyses of natural gases, 1986. Information Circular/1987 (Annual).** Moore, B.J.; Sigler, S. (Bureau of Mines, Amarillo, TX (USA). Helium Field Operations). 1986. 106p. (BM-IC—9167). NTIS, PC A06/MF A01.

See also PB—87-164430.

This publication contains analyses and related source data for 274 natural gas samples from 20 States. Of the total samples, 269 were collected during calendar year 1985; the remainder were collected earlier, but releases granting permission to publish were not received before 1986. All samples were obtained and analyzed as part of Bureau of Mines investigations of the occurrences of helium in natural gases of countries with free market economies. The survey has been conducted since 1917. The analyses published herein were made by mass spectrometer and chromatograph.

0340 Combustion

REFER ALSO TO CITATION(S) 57136

56169 **(LTKK-EN—B62) Development of a domestic gas turbine for energy coversion of medium and low heat value gases.** Larjola, J. (Lappeenrannan Teknillinen Korkeakoulu (Finland). Energiatekniikan Laitos). Oct 1987. 174p. (In Finnish). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88754861/JAW.

The aim of the project is to develope a domestic gas turbine for the utilization of biogas, LHV-gas and natural gas. The designed gas turbine is based on oil-free high speed technology (gas and magnetic bearings) and on recuperated cycle with radial turbomachinery. Typical output range of the whole installation is 0.23-5

MW/sub e/. Main applications of the designed gas turbine will be a small-scale production of electricity (and district heat) by 1) low heat value gas obtained by gasification of peat, wood or equivalent solid fuel, 2) biogas produced at dumping areas of solid and liquid waste and 3) near-customer production of electricity and heat by natural gas. If the plant will be reliable and easy to operate, it may have good export markets in developing countries. Compared to other ways of small-scale energy production from domestic fuels, this gas turbine process seems to be advantageous.

56170 **(PB—88-239942/XAB) Radiative heat transfer. Annual report, January 1987-March 1988.** Chapman, K.S.; Harder, R.F.; Ramadhyani, S.; Viskanta, R. (Purdue Univ., Lafayette, IN (USA). School of Mechanical Engineering). Jun 1988. 132p. NTIS, PC A07/MF A01.

A one-dimensional mathematical model was developed to predict the steady-state thermal performance of natural-gas-fired once-through and single-ended radiant tubes. The model predictions were compared with available experimental data for the purpose of validating the model. A simple two-dimensional model of a once-through radiant tube has also been developed to predict the combustion characteristics and the flame length. A transient, zero-dimensional (stirred furnace) model has been developed to predict the thermal performance and the temperature distribution in the load inside a batch-heating furnace. Parametric calculations were performed to identify the firing conditions for improving performance of the furnace.

0350 Storage

56171 **(PB—88-240916/XAB) Characterization of produced waters from underground natural-gas-storage reservoir operations. Volume 1. Topical report, July 1986-June 1988.** Wesolowski, D.; Broughton, A.; Hansotte, C.A.; Koraido, S.M.; Fillo, J.P. (ERT, Inc., Pittsburgh, PA (USA)). Jun 1988. 188p. NTIS, PC A09/MF A01.

See also PB—88-173083.

This report presents the results of a nationwide characterization program for produced waters from underground natural-gas-storage operations. In all, seven produced-water samples from seven different sites were collected and analyzed. The results of the program indicate that the characteristics and volumes of production waters from storage facilities are highly variable, site-specific, and most likely dependent on the characteristics of the storage formation. In general, the produced waters from storage facilities sampled in the program contained volatile organics and, to a lesser degree, selected semivolatile organics. Selected minor and trace elements also were present in the produced-water samples. Chloride and total dissolved solids were the most-predominant conventional parameters detected. Produced waters did not generally exhibit current RCRA hazardous-waste characteristics. The predominant method used to dispose of these waters is underground injection into Class II wells regulated under the Safe Drinking Water Act.

04 OIL SHALES AND TAR SANDS

0402 Site Geology And Hydrology

56172 **(CIM—1988) Geology and geological engineering at Syncrude.** O'Donnell, N. (Canadian Inst. of Mining and Metallurgy, Montreal, Quebec). 1988. 18p. (CONF-8805204—; CE—01918). Petroleum Society of the CIM, 229 - 640 Fifth Ave., S.W., Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

From 90. CIM annual general meeting; Edmonton, Canada (8 May 1988).

This paper outlines the geology of the Athabasca oil sand deposit and describes the activities of the Mine Geology Section of Syncrude Canada, which operates an oil sand mine in that deposit. The Section serves the mine by providing information in support of a variety of operating functions. It is composed of five specialized teams, each one concerned with accurate, detailed data of practical value. Recognition of the unique geological and geotechnical characteristics of each portion of the base mine is reflected in the approach to the work. The Highwall Mapping and Geological Interpretation Team supports three mine planning groups, geotechnical engineering and dragline operations. Ore grading supplies reserve quality and quantity data to planners and to extraction technical staff covering terms ranging from daily to 25 years. The Overburden and Granular Resources Team provides overburden engineering with the information needed for planning of stripping operations, and ensure valuable sand and gravel reserves are identified for mine haul roads and other construction needs. The Hydrogeology and Groundwater Team supports the depressurization operation and environmental monitoring of tailings operations in conjunction with Environmental Affairs. The Drill Programs Team collects data which the other four teams utilize in the course of carrying out their responsibilities. 30 refs., 14 figs.

0403 Drilling, Fracturing, And Mining

REFER ALSO TO CITATION(S) 56034, 56069, 56186

56173 **(CIM—1988) Technical support to the Syncrude oilsands mine.** McKee, W.N. (Canadian Inst. of Mining and Metallurgy, Montreal, Quebec). 1988. 7p. (CONF-8805204—; CE—01916). Petroleum Society of the CIM, 229 - 640 Fifth Ave., S.W., Calgary, Alta., Canada T2P 3G4; $3.10 CAN.

From 90. CIM annual general meeting; Edmonton, Canada (8 May 1988).

The Syncrude Canada Oilsand Mine has operated for the past ten years, achieving a successful startup and a consistent upward trend in ore production each year. The high production level, along with a significant reduction in unit cost, have been accomplished through the efforts of the operating and technical organizations in overcoming the complexities of the mine and tailings operations. The size and complexity of the operations have necessitated the creation of a large mining technical organization covering a wide range of disciplines and activities, including project management, design engineering, research development and computer systems. The factors which make the Syncrude mine and tailings operation unique and challenging are outlined as an introduction to the organization and functions of the mining technical groups. The resources and activities of each technical area are described, giving an insight into the size and diversity of the Mining technical organization. 2 figs.

56174 **(CIM—1988) An overview of the Syncrude oilsands mine.** McKee, W.N. (Canadian Inst. of Mining and Metallurgy, Montreal, Quebec). 1988. 13p. (CONF-8805204—; CE—01917). Petroleum Society of the CIM, 229 - 640 Fifth Ave., S.W., Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

From 90. CIM annual general meeting; Edmonton, Canada (8 May 1988).

The Syncrude Canada operation has been producing crude oil from a surface oilsand deposit since 1987. The surface mine currently supplies an average of 300,00 tonnes/d of ore to the extraction plant, utilizing a stripmining method with draglines, bucket-wheel reclaimers, and conveyors. Overburden is removed in advance of the production operation by a large fleet of haul trucks and shovels at a rate of 210,000 tonnes/d. The waste product after bitumen recovery by the extraction plant is pumped as a slurry to the tailings disposal area. The Syncrude mining organization has been successful over the past ten years in the start-up and operation of the mine and tailings areas, exceeding the aggressive production and unit cost targets on a consistent basis. This performance record has been accomplished by overcoming the complexities inherent in the operation through the efforts of the operating and technical organizations. Some of the challenges and successes of the mine and tailings operations are highlighted in the overview of each major component of the total operation. 4 refs., 15 figs.

56175 **(CIM—1988) Highwall geotechnical engineering at Syncrude.** Holmes, G.F.; List, B.R. (Canadian Inst. of Mining and Metallurgy, Montreal, Quebec). 1988. 8p. (CONF-8805204—; CE—01919). Petroleum Society of the CIM, 229 - 640 Fifth Ave., S.W., Calgary, Alta., Canada T2P 3G4; $4.00 CAN.

From 90. CIM annual general meeting; Edmonton, Canada (8 May 1988).

Local adverse structural geology combined with gas exsolution from bitumen, high pore pressures and stress relief contribute to an extensive highwall geotechnical program at Syncrude's oil sand mine. Site investigations along the ten kilometers of highwall are required to define any adverse geotechnical conditions that may lead to any of the five recorded modes of failures. A geotechnical organization comprising of highwall monitoring engineers, instrumentation engineers, highwall analysis and design engineers and geotechical project engineers is required to ensure the risk of highwall instability on dragline mining is kept to a miniumum. Alternate highwall designs, remedial stabilization plans plus instrumentation and highwall monitoring programs are discussed along with the impact of highwall instability on the dragline mining operation. 9 figs.

56176 (CIM—1988) Short term mine planning at Syncrude. Malhotra, Y.P.; List, S.J. (Canadian Inst. of Mining and Metallurgy, Montreal, Quebec). 1988. 14p. (CONF-8805204—; CE—01920). Petroleum Society of the CIM, 229 - 640 Fifth Ave., S.W., Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

From 90. CIM annual general meeting; Edmonton, Canada (8 May 1988).

The Syncrude Canada Mine has been in operation for the past ten years, producing synthetic crude oil from Athabasca oilsand with a consistently upward trend in production each year. The open-pit mine currently delivers an average of 300,000 tonnes of oilsand per day to the extraction plant. For the mining of the oilsand, the mine is equipped with four draglines, four bucketwheel reclaimer/conveyor systems and an auxilliary production system to supplement major equipment production. Overburden is stripped by a large fleet of shovels and trucks. All these systems combined will handle approximately 325 million tonnes of material in 1988. The effective technical support is crucial to the achievement of high production objectives. The short term mine planning functions to achieve these objectives, are performed by two groups: Overburden Engineering and Short Range Planning. The short term plans range from day to day operating plans to one year mine plans. This paper discusses the short term planning process, the complexities and some of the challenges faced by the mine planning engineers. 5 refs., 10 figs.

56177 (CIM—1988) Long term mine planning at Syncrude. Donald, D.A. (Canadian Inst. of Mining and Metallurgy, Montreal, Quebec). 1988. 10p. (CONF-8805204—; CE—01921). Petroleum Society of the CIM, 229 - 640 Fifth Ave., S.W., Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

From 90. CIM annual general meeting; Edmonton, Canada (8 May 1988).

Long term mine planning for the Syncrude mining operation in Alberta is performed by two teams, Long Range Planning (LRP) and Intermediate Planning and Economics (IPE). This paper reviews the organizational structures and the planning processes of the two teams, some of the major mining problems encountered, and the challenges yet to come. It also examines the future mining direction and summarizes the distribution of mining costs. 15 figs.

56178 (CIM—1988) Research and maintenance engineering support to the Syncrude mining operation. Kershaw, D. (Canadian Inst. of Mining and Metallurgy, Montreal, Quebec). 1988. 7p. (CONF-8805204—; CE—01923). Petroleum Society of the CIM, 229 - 640 Fifth Ave., S.W., Calgary, Alta., Canada T2P 3G4; $3.50 CAN.

From 90. CIM annual general meeting; Edmonton, Canada (8 May 1988).

A world-scale surface mining operation is associated with the Syncrude Oilsands Plant in Alberta. Each day over 300,000 tonnes of oil sand are mined and transported to the process plant to produce 129,000 barrels of synthetic crude oil. Examples of research and maintenance engineering programs which have resulted in substantial gains in dragline and bucketwheel conveyor system productivities are discussed. Two central themes within these programs, which go beyond the usual technical support associated with a large surface mining operation, are pursued. One approach taken is to determine the causes of component failures and to provide Syncrude with performance specifications in order to allow the manufacturing industry to respond with more appropriate products. Also, systems and equipment studies have led to higher productivity in the major pieces of mining equipment and to the development of an auxiliary feed system. 12 figs.

56179 (PB—88-229893/XAB) Leakage and performance characteristics of large stoppings for room-and-pillar mining. Report of Investigations/1988. Thimons, E.D.; Brechtel, C.E.; Adam, M.E.; Agapito, J.F.T. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1988. 24p. (BM-RI—9148). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600351.

The construction costs, leakage measurements, and predicted performance of different types of large stoppings built and tested in a room-and-pillar oil-shale mine were compared. The six full-sized structures (30 ft high by 55 ft wide) included both permanent and temporary stoppings and were fabricated using materials ranging from structural steel to coated brattice cloth. Leakage across each stopping was measured at differential pressures ranging up to 1.0 in w.g., using both the brattice-window method and sulfur hexafluoride tracer gas. Blast air pressures resulting from full-scale face blast of approximately 1,800 lb of ammonium nitrate-fuel oil (ANFO) explosives were measured across two of the stoppings, and the pre- and post-leakage rates were compared for all the stoppings.

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 56010, 56092

56180 (AE/SESR—I-229) Opportunities to use coal in enhanced oil recovery. (Alberta Energy, Edmonton (Canada). Scientific and Engineering Services and Research Div.). 1988. 8p. (MICROLOG—88-04011). Alberta Dept. of Energy, Petroleum Plaza Twr., 9915-108 St., Edmonton, Alta., Canada T5K 2C9; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Of the various oil recovery methods tried in Alberta's oil sand/heavy oil deposits, steam injection has become accepted for the major deposits. Currently, operations using steam injection generate the steam in natural gas-fired boilers, but the relative close proximity of subbituminous coal deposits has raised the question as to whether coal might be used as the boiler fuel. It is noted in this report that a study was undertaken in 1985 to determine the feasibility of doing this. On the basis that the projected production levels of oil sands/heavy oil would be realized, this study found that 10.5 to 17.3 megatonnes of subbituminous coal would be needed annually as steam-injection boiler fuel (including conversion of existing gas-fired units). This figure represents 70-110% of current subbituminous production. Economic viability, technical acceptability, transport, and environmental considerations were also studied. It was concluded that the projected production in the oil sand/heavy oil areas was sufficient to allow coal to become economically competitive with natural gas for steam injection boiler fuel, and that proven reserves are more than adequate to satisfy demand for 25 years. Economics of coal use were most sensitive to changes in natural gas prices and capital costs. This paper also summarizes work being done in the Coal Combustion Research Program, which includes a project for coal use in enhanced oil recovery, and designing of innovative coal-fired steam generators and combustors. 3 tabs.

56181 (CIM—1988) Coal as a fuel option in enhanced oil recovery. Elder, P.W.; LaFleur, L.R. (Canadian Inst. of Mining and Metallurgy, Montreal, Quebec). 1988. 12p. (CONF-8805204—; CE—01925). Petroleum Society of the CIM, 229 - 640 Fifth Ave., S.W., Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

From 90. CIM annual general meeting; Edmonton, Canada (8 May 1988).

Alberta's total coal resources are estimated to be 2,600 gigatonnes. Subbituminous plains coals represent by far the largest quantities with 790 gigatonnes potentially recoverable. Characteristics of this coal may make it a preferred fuel for the thermal oil

recovery market: the coal is generally located very close to the surface with low mining costs, the markets (heavy oil fields) are close to the potential mining areas, and the coal properties mean a lack of suitability for transport to distant markets. This, combined with the very large reserves, makes the mine mouth cost of the coal entirely dependent on cost of service (mining). The delivered cost of this coal is, therefore, projected to be both low and stable. The primary goal of this work is to show that coal can be used as fuel to generate steam at pressures required for in-situ heavy oil recovery. A demonstration steam generator is being designed especially for such use, and a demonstration project is being established to test its performance. The economics of coal in such steam generation has been subjected to preliminary calculation. Savings in fuel cost (with respect to natural gas) required to pay out the additional capital and operating costs of the coal firing systems within a 3-year period are estimated at $0.50/Btu. Since the delivered cost of coal to the Cold Lake area is calculated at $1.66/Btu, the natural gas cost at which coal becomes an economically attractive fuel is $2.16/Btu. 3 refs., 2 figs., 2 tabs.

56182 **(NIPER—328) Improved oil mining: A feasibility study: Final report.** Tham, M.K.; Carroll, H.B. Jr. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Sep 1988. Contract FC22-83FE60149. 374p. NTIS, PC A16/MF A01. Order Number DE88001231/JAW.

The feasibility of the use of advance mining and petroleum production technologies for oil recovery by improved oil mining was investigated. The study included a thorough review of oil mining technology, geological aspects of improved oil mining, resource evaluation, and resources amenable to improved oil mining including candidate reservoirs that passed initial screening criteria. The technology for slant/horizontal drilling was reviewed. Reservoir engineering and production engineering aspects of improved oil mining were studied, and the applicability of enhanced oil recovery methods in improved oil mining was investigated. Existing safety standards and regulations for improved oil mining were compiled. The work included a study of Caddo Pine Island field in Louisiana as a candidate reservoir for a demonstration project for field research on improved oil mining. The economic feasibility of improved oil mining was studied, and different scenarios were prepared. 212 refs., 42 figs., 24 tabs.

56183 **(UCID—21507) Thermal cracking of hydrocarbons.** Braun, R.L.; Burnham, A.K. (Lawrence Livermore National Lab., CA (USA)). Sep 1988. Contract W-7405-ENG-48. 22p. NTIS, PC A03/MF A01. Order Number DE89000661/JAW.

Knowledge of thermal cracking of hydrocarbons is important in understanding and modeling petroleum maturation. We have reviewed the literature on the thermal cracking of pure hydrocarbons and mixtures of hydrocarbons, with particular attention given to dependence of the kinetics on temperature, pressure, and phase. Major uncertainties remain with regard to pressure dependence. Based on this review, we developed a simple, four-component, three-reaction model for oil-cracking. We also developed a simple, kerogen-maturation, kinetic model that incorporates hydrogen and carbon balance and includes the most important oil- and gas-forming reactions: kerogen pyrolysis, three oil-cracking reactions, and three coke-pyrolysis reactions. Tentative stoichiometry parameters are given for lacustrine and marine kerogens. 35 refs., 5 figs., 5 tabs.

0405 Properties And Composition

56184 **(CIM—1988) Correlation between oil sands minerals and processing characteristics.** Mikula, R.J.; Munoz, V.A. (Canadian Inst. of Mining and Metallurgy, Montreal, Quebec). 1988. 15p. (CONF-8805204—; CE—01929). Petroleum Society of the CIM, 229 - 640 Fifth Ave., S.W., Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

From 90. CIM annual general meeting; Edmonton, Canada (8 May 1988).

The behavior of tar sands during processing is determined by several factors, including the mineralogy of the tar sands feed. The amount and size distribution of the clays are important, as is the composition of the mineral components. Preliminary studies have shown that, other things being equal, iron containing minerals such as siderite have a stabilizing influence on some of the emulsions formed during extraction of the bitumen. The mineralogical information which can be obtained in the electron microprobe is important in establishing the correlations between processing characteristics and mineral composition and the use of both optical and scanning electron microscopy has been demonstrated for the characterization of these systems. The size distribution and compositional information available using these techniques is not qualified by mineral crystalinity (as is the case with x-ray diffraction) or by inspecting total elemental concentrations obtained by simple chemical analysis. Although these preliminary results point to interesting correlations between specific iron containing mineral components and the processing behavior, the tar sands mineralogy is so complex that unequivocal conclusions are not possible at this time. Many factors can be important and synergistic effects from two or more individually innocuous components may also lead to extraction problems. 8 refs., 5 figs.

0406 Direct Uses And By-products

56185 **(EMR/MS—8512) Sulphur and metals capture during combustion of Syncrude coke in a circulating fluidized bed combustion.** Hamer, C.A.; Liang, D.T. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario. Mineral Sciences Labs.). Dec 1985. 12p. (MICROLOG—88-03894). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

A pilot-scale circulating fluidized bed combustor has been designed, built and put into operation to investigate SO/sub 2/, heavy metal, and alkali emissions, their capture with sorbents and their corrosive effects. In this study, the combustor was used to examine the combustion of Syncrude by-product petroleum coke, a residue from the upgrading of oil sand bitumen by fluid coking. This coke presents unique problems when used as fuel: it is relatively unreactive, has high sulfur and heavy metal content, low volatiles and is difficult to grind. This paper begins with a detailed description of the combustor and its main components: the dense bed section, the combustor column and the high temperature cyclone with a hot solids return leg. In the experiments, Alberta limestone was used as a sorbent in all the tests. This limestone, along with other sorbents from Alberta and the Canadian Maritime provinces, was evaluated for its ability to react with sulfur dioxide gas in the fluidized bed. It was blended with coke in a Ca/S ratio of 2. Sulfur dioxide capture was around 90% for three tests. Corrosion in the stainless steel parts of the combustor was examined and some detected. The nature of vanadium in the coke is discussed, and the content of this and other metals in the ash analyzed. The results from these preliminary studies indicate that Syncrude coke can be combusted without significant problems. 8 refs., 1 fig., 3 tabs.

0409 Waste Research And Management

56186 **(CIM—1988) Tailings engineering at Syncrude.** Yano, L.T.; Handford, G.T. (Canadian Inst. of Mining and Metallurgy, Montreal, Quebec). 1988. 5p. (CONF-8805204—; CE—01922). Petroleum Society of the CIM, 229 - 640 Fifth Ave., S.W., Calgary, Alta., Canada T2P 3G4; $2.00 CAN.

From 90. CIM annual general meeting; Edmonton, Canada (8 May 1988).

The size of the tailings disposal operation has led to the establishment of a large engineering team devoted solely to the disposal of tailings at the Syncrude oilsand mine in Alberta. This paper discusses the tailings disposal operation, the role of the tailings engineering personnel, the organization, interfaces, and the present and future challenges with respect to tailings disposal. The tailings engeering team has the responsibility for planning and coordinating tailings disposal and for encuring the stability of the tailings dyke. The inclusion of both the planning and geotechnical functions in one team has resulted in greater efficiency in the design and planning process. Major challenges in tailings disposal facing Syncrude are in the areas of: sludge disposal, instrumentation and monitoring, and managing liquefaction failure risk. Meeting these

challenges will have a significant effect on the cost effectiveness and reliability of the mining operation. 4 refs., 4 figs.

0410 Environmental Aspects

REFER ALSO TO CITATION(S) 56712

56187 (AFLW/FS—T/149) Evaluation of trees and shrubs for oil sands reclamation: field trial results. (Alberta Dept. of Forestry, Lands and Wildlife, Edmonton (Canada). Forest Service). 1987. 50p. (MICROLOG—88-03956). Alberta Forest Service, Petroleum Plaza Tower, 9915-108 St., Edmonton, Alta., Canada T5K 2C9; $N/C; MF CANMET/TID, Energy, Mines and Resources CAN, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This project was initiated to select suitable tree and shrub species for use in revegetating spoils and tailings resulting from oil sand mining in Alberta. As part of this program, three field trials were established to test one or more provenances (seed sources) of promising native and exotic woody species. The trial site was prepared to simulate an oil sands reclamation situation. Overburden and peat were hauled to the site from Syncrude's mining lease and incorporated in native sand. The resulting soil was alkaline (pH 7.5), non-saline, and low in available N, P, and K, with no fertilizers added. All species were outplanted as one- or two-year-old container stock. All seed used to rear the native species was collected from local populations. Survival rates were high for most species. Girdling damage by small mammals was almost nonexistent, probably because of fine-mesh fencing installed around the test site. Populus Northwest and P. Tristis #1 were the tallest and fastest growing species. Among the native species, Pinus banksiana was the tallest and fastest growing. Several other species also performed well and may be suitable for oil sands reclamation, such as caragana, spruces, and Populus Brooks #6. Some gave mediocre or inconsistent performances, including birches, Populus Walker, and Vaccinium vitis-idaea. The remaining species were failures and may not be adapted to the test site environment, including Alnus tenuifolia/crispa, Populus tremuloides, Rosa woodsii, willows, and Ulmus pumila. The few significant differences found among provenances for any of the native species suggests that genotypic differences were small among the populations tested. 10 refs., 1 fig., 13 tabs.

05 NUCLEAR FUELS

56188 (DOE/EIA—0436(88)) World nuclear fuel cycle requirements, 1988. (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 30 Sep 1988. 110p. NTIS, PC A06/MF A01 - GPO. Order Number DE89001022/JAW.

This report contains an analysis of the sensitivities of the nuclear fuel cycle projections to different levels and types of projected nuclear capacity, different enrichment tails assays, higher and lower capacity factors, changes in nuclear fuel burnup levels, and other exogenous assumptions. The projections for the United States generally extend through the year 2020, and the (WOCA) World Outside Centrally Planned Economic Areas projections, which include the United States, are provided through 2010. The report also presents annual projections of spent nuclear fuel discharges and inventories of spent fuel. Appendix E includes aggregated domestic spent fuel projections through the year 2020 for the Lower and Upper References cases and through 2037, the last year in which spent fuel is discharged, for the No New Orders case. Annual projections of spent fuel discharges through the year 2037 for individual US reactors in the No New Orders cases are included for the first time in Appendix H. These disaggregated projections are provided at the request of the Department of Energy's Office of Civilian Radioactive Waste Management.

0501 Reserves, Exploration, And Mining

REFER ALSO TO CITATION(S) 56354

56189 (DOE/EIA—0478(87)) Uranium industry annual, 1987. (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 29 Sep 1988. 144p. NTIS, PC A07/MF A01 - GPO. Order Number DE89000463/JAW.

This report provides current statistical data on the US uranium industry for the Congress, federal and state agencies, the uranium and utility industries, and the public. It utilizes data from the mandatory "Uranium Industry Annual Survey," Form EIA-858; historical data collected by the Energy Information Administration (EIA) and by the Grand Junction (Colorado) Project Office of the Idaho Operations Office of the US Department of Energy (DOE); and other data from federal agencies that preceded the DOE. The data provide a comprehensive statistical characterization of the industry's annual activities and include some information about industry plans and commitments over the next several years. Where these data are presented in aggregate form, care has been taken to protect the confidentiality of company-specific data while still conveying an accurate and complete statistical representation of the industry data.

56190 (INIS-BR—1209) Study pf apatite accurrence from Gaviao and Serra de Jacabina gold deposit by scintillometry and gamma spectrometry. Barreto, P.T. (Bahia Univ., Salvador (Brazil)). 1974. 67p. (In Portuguese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704001/JAW.

This work presents the results of radiogeologic reconnaissance in the Cenozoic, Mesozoic and Pre-Cambrian formations, localized between Salvador and Miguel Calmon, and of the radiogeologic detail study from areas of the radioactive anomalies: Gaviao in the Riacho do Lacuipe and Canavieira Mine, in the Jacobina, Bahia States Scintilometry and gamma spectrometry results make possible to conclude by the association, in the Gaviao's apatite mineralization with throrium and the gold of the Serra de Corrego's conglamerate with uranium, make possible in the both case, orient the Search and the mining by scintilometry. The petrographic study and the radiactivity elements dispersion, suggest a sedimentary primary origin to the regional metamorphic rocks. In the Canavieiras mine was evident the stratigraphic control of the gold, associated to uranium and pirite in the conglomerates. (C.D.G.).

56191 (INIS-BR—1262) Method of double tracer addition for determining uranium in geological samples by mass spectrometric isotope dilution. Shihomatsu, H.M.; Iyer, S.S. (Sociedade Brasileira de Geoquimica, Rio de Janeiro (Brazil)). 1987. 10p. (In Portuguese). (CONF-8710388—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704255/JAW.

From 1. Brazilian congress on geochemistry; Porto Alegre, Brazil (30 Oct 1987).

The present work shows the experimental details on the uranium determination in materials by mass spectrometric isotope dilution technique with double tracer (/sup 233/U + /sup 235/U). The mass discrimination phenomenon effect is studied. The uranium concentration values obtained by mass spectrometric isotope dilution technique with double tracer are compared with other techniques. The influence of the sampling in the accurate determination of uranium in the rock sample is discussed.

56192 (INIS-BR—1263) Solution of some critical problems in X-ray fluorescence. II - Determination of Nb and Ta traces in concentrates. Ferreira, O.L.; De Morais, D. (Sociedade Brasileira de Geoquimica, Rio de Janeiro (Brazil)). 1987. 6p. (In Portuguese). (CONF-8710388—).

From 1. Brazilian congress on geochemistry; Porto Alegre, Brazil (30 Oct 1987).

Two straightforward methods are proposed for quantitative analysis of Nb and Ta traces in heavy fractions of mineral samples by using X-ray fluorescence technique. The first one consist in calculating the background intensity by the weighted average of the

asymmetrical intensities values mesured in each side of Nb Kα line. The second method corrects the overlap of Th Lβ and Ta Lα by the experimentally obtained ratios between different Th excitation lines.

56193 **(INIS-BR—1264) Determination of rare-earth elements in geological materials by ion-exchange chromatography separation and induction coupled plasma emission spectroscopy.** Diaz, M.; Iyer, S.S.; Kakazu, M.H.; Reino, L.C.P. (Sao Paulo Univ. (Brazil). Inst. de Geociencias). (Sociedade Brasileira de Geoquimica, Rio de Janeiro (Brazil)). 1987. 17p. (In Portuguese). (CONF-8710388—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704257/JAW.

From 1. Brazilian congress on geochemistry; Porto Alegre, Brazil (30 Oct 1987).

A methodology for the analysis of Rare-Earth elements in geological samples has been developed. Ion exchange chromatography for the separation and induction coupled plasma emission spectroscopy for the analysis have been used. The columns with cationic resin were calibrated with radioactive elements. With complexes matrices, the instrument's data must be corrected for the presence of majors elements (CEM) and for the interferences of the Rare-earth elements (CETR). The accuracy and precision are evaluated critically with respect to the convenience and efficiency of this methodology in the analysis of rare-Earth elements i geological samples.

56194 **(INIS-BR—1265) Development of analytical techniques for determining rare earth elements in geological materials.** Moraes, Noemia M.P. de; Kakazu, M.H.; Iyer, S.S. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). (Sociedade Brasileira de Geoquimica, Rio de Janeiro (Brazil)). 1987. 9p. (In Portuguese). (CONF-8710388—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704258/JAW.

From 1. Brazilian congress on geochemistry; Porto Alegre, Brazil (30 Oct 1987).

This work presents a comparative study between instrumental neutron activation analysis, inductively coupled plasma emission spectrometry and mass spectrometric isotope dilution techniques. Some advantages and disadvantages of the techniques are presented, depending on the type of the analysis required. Emphasis in give upon mass spectrometric isotope dilution, and some procedures for the development of this technique are presented. This methodology is being established by the nuclear and isotopic geology group of the IPEN.

56195 (INIS-mf—11262, pp 113-120) **History of uranium mining in Slovakia.** Badar, J. (Uranovy Prieskum, Spisska Nova Ves (Czechoslovakia)). 1987. (In Slovak). NTIS (US Sales Only), PC A012/MF A01. Order Number DE88704144/JAW. (CONF-8710341—; CONF-8710342—).

From Meeting on noise and statistics: measuring methods and statistical methods for the monitoring and evaluation of noise pollution; Koeln, F.R. Germany (6 Oct 1987).

Uranium survey has been peformed in Slovakia since 1947. More important uranium deposits were found in localities Novoveska Huta - Muran - Hnilcik, Vikartovsky Hrbet (deposits Spissky Stiavnik, Svabovce, Kravany and Vikartovce) and Kalnica - Selec. Survey and mining work at the individual deposits is described. (J.B.).

56196 (INIS-mf—11289, pp 181-190) **Current and prospective orientation of mechanized driving of mines and underground infrastructures.** Borovsky, K. (Vystavba Dolu Uranoveho Prumyslu, Prague (Czechoslovakia)). 1987. (In Czech). NTIS (US Sales Only), PC A18/MF A01. Order Number DE88704148/JAW. (CONF-8710342—).

From Mining Pribram in science and technology; Pribram, Czechoslovakia (12 Oct 1987).

The concern Uranium Industry Mine Building focused its programme on two basic areas, viz.: (i) provision and operation of driving machines for driving without explosives and (ii) provision of rail-less mine mechanization for driving, drawing and lining of mine works, especially of large-area objects and tunnels above 30 m/sup 2/. The technologies are also applied outside uranium mines. Some experience is presented with the service use of mine technology. (J.B.).

56197 (INIS-mf—11289, pp 295-310) **Operation of rail-less mine mechanization in the Hamr area.** Vyhnanek, J. (Uranove Doly, Hamr (Czechoslovakia)). 1987. (In Czech). NTIS (US Sales Only), PC A18/MF A01. Order Number DE88704148/JAW. (CONF-8710342—).

From Mining Pribram in science and technology; Pribram, Czechoslovakia (12 Oct 1987).

Mining technology is described used in uranium mines at Hamr, and the specifications are given of the individual machines, such as loaders, drilling vehicles, platforms, containers, and bolting cars. (J.B.).

0504 Feed Processing

REFER ALSO TO CITATION(S) 57082

0505 Uranium Enrichment

56198 **(DOE/ID—10197-Vol.2) Report of public meetings on the draft environmental impact statement, DOE/EIS-0136: Special Isotope Separation Project: Volume 2, Proceedings of the meeting held March 25, 1988, at University Place, Idaho Falls, ID.** (Idaho National Engineering Lab., Idaho Falls (USA)). Apr 1988. Contract AC07-76ID01570. 183p. (CONF-8803145—Vol.2). NTIS, PC A09/MF A01. Order Number DE88016923/JAW.

From Public meetings on the draft environmental impact statement-DOE/EIS-0136; Idaho Falls, ID, USA (25 Mar 1988).

This document describes public hearings held to receive comment on the Draft Environmental Impact Statement for the proposed siting, construction, and operation by the Department of Energy of a Special Isotope Separation Project utilizing the Atomic Vapor Laser Isotope Separation Process Technology (SIS Project). All interested organizations and individuals may comment on the DEIS. The Department's proposes to site, construct, and operate an SIS facility either at DOE's Idaho National Engineering Laboratory near Idaho Falls; the DOE's Hanford Reservation near Richland, Washington; or, the DOE's Savannah River Plant near Aiken, South Carolina. Each of these sites is designated as an alternative that is considered in the Draft EIS. The fourth and final alternative under consideration in the DEIS is the No Action Alternative.

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 56968, 57129

56199 **(DPST—87-729) Formation of U_4O_9 in heated U_3O_8-Al powders and compacts.** Peacock, H.B. (Savannah River Lab., Aiken, SC (USA)). 9 Oct 1987. Contract AC09-76SR00001. 15p. NTIS, PC A03/MF A01. Order Number DE89000487/JAW.

Cermet fuel elements for nuclear reactors can be made by powder metallurgy (PM) technology. Uranium oxide and aluminum powders are blended, compacted, placed in aluminum components and either rolled or extruded to make the elements. Uranium oxide (U_3O_8) and aluminum fuel elements are used in the ORR and HFIR reactors at Oak Ridge and in HFBR reactor at Brookhaven. Recently, Argonne National Laboratory carried out extensive tests of highly loaded U_3O_8 and aluminum fuel elements as part of the Reduced Enrichment for Research and Test Reactors (RERTR) program for the Department of Energy. An advantage of the U_3O_8 and aluminum fuel is that elements can be fabricated with higher uranium contents than is possible with cast uranium and aluminum alloy. The Savannah River Laboratory has evaluated the U_3O_8 and aluminum cermet technology. This report presents information on the reduction of U_3O_8 to U_4O_9 when compacts are heated. When compacted powders are heated above 500{degree}C, reduction of the uranium oxide by aluminum occurs. Solid state reactions between U_3O_8 and aluminum have not been reported at temperatures below about 500{degree}C, but reactions to produce uranium alu-

minides have occurred at 600{degree}C in unirradiated fuel. 16 refs., 5 figs.

56200 (NUREG/CR—5212) Emergency environmental sampling and analysis for radioactive material facilities. Stoetzel, G.A.; Lynch, T.P. (Nuclear Regulatory Commission, Washington, DC (USA); Pacific Northwest Lab., Richland, WA (USA)). Aug 1988. Contract AC06-76RL01830. 74p. (PNL—6625). NTIS, PC A04/MF A01 - GPO. Order Number TI89000223/JAW.

This report provides information that could be used by radioactive material facilities for developing or improving environmental sampling and analysis programs for emergency conditions. Areas that need to be addressed during the planning phase of such a program include 1) emergency organization, 2) sample collection and measurement locations, 3) required equipment and supplies, 4) sample collection procedures, 5) field measurement methods, 6) recordkeeping methods, and 7) quality assurance program. Emphasis is with any supporting agencies, such as state and federal monitoring teams who with any supporting agencies, such as state and federal monitoring teams who might respond. The report also reviews the responsibilities and current capabilities of radioactive material facilities, state and local government agencies, and federal agencies with regard to environmental sampling and analysis in an emergency situation. 36 refs., 11 figs., 13 tabs.

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 56300, 56329, 56344, 56345, 56346, 56347, 56348, 56349, 56350, 56351, 56352, 57077

56201 (CEA-tr—2216) Study of the bibliography relative to U0/sub 2/ dissolution kinetics in nitric acid. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Dec 1986. 91p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755003/JAW.

The dissolution of U0/sub 2/ in nitric acid alone or containing nitrates is studied. The influence of the following parameters: nitric acid concentration, nitrates concentration (without uranyl nitrate) uranyl nitrate concentration, stirring, nitrous acid concentration, temperature, density, surface, 0/U ratio, geometry (cut lenghth, orientation and surface) residues, fluorine concentration on dissolution kinetics of U0/sub 2/ or spent fuel of light water reactors is reviewed.

56202 (CONF-881011—15) Validation of the SCALE code system using criticality data from experiments performed with Pu + U solutions in cylindrical and slab geometry. Smolen, G.R.; Funabashi, H. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013845/JAW.

From Joint meeting of the European Nuclear Society and the American Nuclear Society; Washington, DC, USA (30 Oct 1988).

This paper outlines the results of a calculational study that was performed to validate two versions of the SCALE computer code system using data from critical experiments performed with mixed Pu + U aqueous solutions. The critical experiments were conducted in a 35-cm-diam cylinder and variable thickness slab tank. A companion paper reports on the criticality data that was obtained. These experimental activities are part of a joint exchange program between the US Department of Energy (USDOE) and the Power Reactor and Nuclear Fuel Development Corporation (PNC) of Japan in the area of criticality data development. The Consolidated Fuel Reprocessing Program (CFRP) at Oak Ridge National Laboratory (ORNL) manages the program for the USDOE. The experiments were conducted at the Battelle Pacific Northwest Laboratories-Critical Mass Laboratory (PNL-CML). 5 refs., 1 fig., 1 tab.

56203 (DOE—22-159-Rev.A) Software coding specification: Prototypical Consolidation Demonstration Project (PCDP): Phase 2. Beck, R.R. (Nutech Engineers, Inc., San Jose, CA (USA)). Dec 1987. Contract AC07-86ID12647. 293p. NTIS, PC A13/MF A01. Order Number DE88015019/JAW.

This manual describes the software design for the Prototypical Consolidation Demonstration Project (PCDP) control system.

56204 (DP—1737) Uranium analysis by remote fiber fluorimetry. Malstrom, R.A. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Jun 1988. Contract AC09-76SR00001. 75p. NTIS, PC A04/MF A01. Order Number DE89000632/JAW.

A Remote Fiber Fluorimetry (RFF) system was developed to monitor uranium concentration online in the Savannah River Plant Separation facilities. The RFF system is designed to measure up to 100 process streams with a totally passive sample-end. The system can monitor uranium in nitric acid streams (0.5-4M) with an uncertainty of less than 10%. The lower detection limit for uranium is 200 ppM (0.001M) in 0.5M nitric acid. In a phosphoric acid system the detection limit is 0.120 ppM. Key components of the RFF system are a Spectra Physics DCR-11 Nd:YAG laser system coupled to a frequency tripler, and a Raman shifter for totally passive generation of a 416 nm excitation frequency. A ruby sphere is used at the sample-end to provide fluorescence feedback for internal correction of variations in laser pulse intensities. A micro-VAX I computer running Fortran under VMS is used to control the entire system. A Princeton Applied Research Model III diode-array detection system captures the emission signal. The entire system requires electrical power at 208 V, nitrogen gas, and water to operate. It can run unattended for several months. System hardware costs were approximately $130,000. Software costs were approximately $30,000.

56205 (DP—1759) Solvent degradation products in nuclear fuel processing solvents. Shook, H.E. Jr. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Jun 1988. Contract AC09-76SR00001. 17p. NTIS, PC A03/MF A01. Order Number DE89001169/JAW.

The Savannah River Plant uses a modified Purex process to recover enriched uranium and separate fission products. This process uses 7.5% tri-n-butyl phosphate (TBP) dissolved in normal paraffin hydrocarbons for the solvent extraction of a nitric acid solution containing the materials to be separated. Periodic problems in product decontamination result from solvent degradation. A study to improve process efficiency has identified certain solvent degradation products and suggested mitigation measures. Undecanoic acid, lauric acid, and tridecanoic acid were tentatively identified as diluent degradation products in recycle solvent. These long-chain organic acids affect phase separation and lead to low decontamination factors. Solid phase extraction (SPE) was used to concentrate the organic acids in solvent prior to analysis by high performance liquid chromatography (HPLC). SPE and HPLC methods were optimized in this work for analysis of decanoic acid, undecanoic acid, and lauric acid in solvent. Accelerated solvent degradation studies with 7.5% TBP in normal paraffin hydrocarbons showed that long-chain organic acids and long-chain alkyl butyl phosphoric acids are formed by reactions with nitric acid. Degradation of both tributyl phosphate and hydrocarbon can be minimized with purified normal paraffin replacing the standard grade presently used. 12 refs., 1 fig., 3 tabs.

56206 (PB—88-867619/XAB) Sol-gel processes and materials. January 1970-August 1988 (Citations from the US Patent data base). Report for January 1970-August 1988. (National Technical Information Service, Springfield, VA (USA)). Aug 1988. 39p. NTIS PC N01/MF N01.

This bibliography contains citations of selected patents concerning Sol-Gel processes and Sol-Gel derived materials and products. Selected patents include Sol-Gel compositions, ceramic and refractory materials, fabrication of silica glass, catalysts and catalyst supports, nuclear fuels preparation, abrasives for grinding wheels, Sol-Gel production of microspheres, Sol-Gel thin films and coat-

ings, photographic materials, and dental materials. (Contains 71 citations fully indexed and including a title list.)

56207 **Continuous aqueous tritium monitor.** McManus, G.J.; Weesner, F.J. US Patent Application 6-109,654. 19 Oct 1987. 11p. Contract AC07-84ID12435. NTIS, PC A03/MF A01.

An apparatus for a selective on-line determination of aqueous tritium concentration is disclosed. A moist air stream of the liquid solution being analyzed is passed through a permeation dryer where the tritium and moisture are selectively removed to a purge air stream. The purge air stream is then analyzed for tritium concentration, humidity, and temperature, which allows computation of liquid tritium concentration. 2 figs.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 56281, 56294

56208 **(CONF-881011—25) Remote retrieval of irradiated EBR-II fuel from in-ground storage silos.** Bacca, J.P.; Wisner, R.S.; Vaughn, M.E.; Taylor, D.S. (Argonne National Lab., Idaho Falls, ID (USA)). 1988. Contract W-31109-ENG-38. 7p. NTIS, PC A02. Order Number DE89000595/JAW.

From Joint meeting of the European Nuclear Society and the American Nuclear Society; Washington, DC, USA (30 Oct 1988).

At the Hot Fuel Examination Facility (HFEF) Complex located at the Argonne National Laboratory-West (ANL-W) Site of the Idaho National Engineering Laboratory (INEL), a remote handling system was developed and operations were conducted which enabled the remote retrieval of irradiated Experimental Breeder Reactor No. 2 (EBR-II) depleted-uranium blanket subassemblies and individual fuel rods in containers from sealed in-ground storage silos at ANL-W. A total of 343 of these irradiated blanket subassemblies and an additional 252 individual rods were safely and efficiently retrieved from their storage silos, transferred to the HFEF/South air-atmosphere hot cell for staging and subsequent loading into shielded shipping casks for shipment to another hot-cell facility for further remote handling and processing. 15 figs.

56209 **(DPST—88-768) An analysis of temperature distributions in TRUPACT II.** Yu, A.D. (Savannah River Lab., Aiken, SC (USA)). 10 Aug 1988. Contract AC09-76SR00001. 7p. NTIS, PC A02/MF A01. Order Number DE89000468/JAW.

Based on a theoretical analysis, the steady-state temperature in a TRUPACT II loaded with 35.4 grams of Pu-238 (20 Watts, 612 Curies) may reach a maximum of 316{degree}F. This maximum temperature can be reduced to 137{degree}F if helium is used in the TRUPACT to replace air. Improvement of temperature predictions can be made by: Heat transfer tests in drums and TRUPACT II; Model development using finite difference/finite element methods. 1 refs., 2 figs.

56210 **(EGG-M—88243) QA in the design and fabrication of the TMI-2 rail cask.** Hayes, G.R. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 14p. (CONF-881077—6). NTIS, PC A03/MF A01. Order Number DE88015220/JAW.

From 15. annual national Energy Division conference; San Antonio, TX, USA (23 Oct 1988).

EG&G Idaho, Inc., acting on behalf of the US Department of Energy, is responsible for transporting core debris from Three Mile Island-Unit 2 to the Idaho National Engineering Laboratory. Transportation of the debris is being accomplished using an NRC licensed container, called the NuPac 125-B. This paper describes the NuPac 125-B Rail Cask and the quality assurance (QA) requirements for that system. Also discussed are the QA roles of the various organizations involved in designing, building, inspecting and testing the NuPac 125-B. The paper presents QA/QC systems implemented during the design, procurement, and fabrication of the cask to assure compliance with all applicable technical codes, standards and regulations. It also goes beyond the requirements aspect and describes unique QA/QC measures employed to assure that the cask was built with minimum QA problems. Finally, the lessons learned from the NuPac 125-B project is discussed. 4 refs., 4 figs.

56211 **(INIS-mf—11799) Compilation of accident statistics in PSE.** Jobst, C. (Transnuklear G.m.b.H., Hanau (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Apr 1983. 27p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755284/JAW.

The objective of the investigations on transportation carried out within the framework of the 'Project - Studies on Safety in Waste Management (PSE II)' is the determination of the risk of accidents in the transportation of radioactive materials by rail. The fault tree analysis is used for the determination of risks in the transportation system. This method offers a possibility for the determination of frequency and consequences of accidents which could lead to an unintended release of radionuclides. The study presented compiles all data obtained from the accident statistics of the Federal German Railways.

56212 (INIS-SU—50, pp 1.1-1.14) **Present status and prospect of spent fuel transportation.** Adachi, H. (Chubu Electric Power Co. Inc., Nagoya (Japan)). 1987. NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780014/JAW. (CONF-8711209—).

From Japan-USSR seminar on transportation and storage of spent fuel; Leningrad, USSR (1 Nov 1987).

Problems linked with spent fuel transportation in Japan, where there are 35 NPPs in operation, are considered. Every year about 500 t U are shipped to fuel reprocessing plants in Japan, as well as in France and UK. Four kinds of casks: HZ, EXCELLOX, TN and TK - are used for this purpose. By the mid-1990's it is suggested to build in Japan fuel reprocessing plant with capacity of 800 t U per year. 3 figs.; 6 tabs.

56213 (INIS-SU—50, pp 2.1-2.8) **Main rules and licensing for transportation and storage of spent fuels in Japan.** Hideaki Murakami. (Tokyo Electric Power Co., Inc. (Japan)). 1987. NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780014/JAW. (CONF-8711209—).

From Japan-USSR seminar on transportation and storage of spent fuel; Leningrad, USSR (1 Nov 1987).

Licensing procedure for spent fuel transportation and storage, which is accepted in Japan and based on the IAEA Transport Regulations, is described. The procedure includes approval of design and control of package manufacturing and operation. 2 figs.; 1 tab.

56214 (INIS-SU—50, pp 3.1-3.10) **Land transportation of spent fuel.** Adachi, H. (Chubu Electric Power Co. Inc., Nagoya (Japan)). 1987. NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780014/JAW. (CONF-8711209—).

From Japan-USSR seminar on transportation and storage of spent fuel; Leningrad, USSR (1 Nov 1987).

On the example of the Hamaoka NPP in Japan, the arrangement of the land transportation system for spent fuel, transported by sea to the reprocessing plants such as Tokai (Japan), COGEMA (France) or BNFR (UK), is described. The land transportation long route is no more, than 10 km (from the NPP to the port), transportation is proved by a line of 5 trailers at the speed of 8 km/h and accompanied by guard, radiation survey and maintenance services cars. To put in order the overseas transportation it is necessary to be done over 30 authorization procedures. Every year it is transported 3 - 4 times, the total number of trips made is 20 and the total amount transported is 215 t U. 3 figs.; 3 tabs.

56215 (INIS-SU—50, pp 4.1-4.10) **Marine transportation of nuclear spent fuel.** Koki Tanaka. (Nuclear Fuel Transport Co., Ltd.). 1987. NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780014/JAW. (CONF-8711209—).

From Japan-USSR seminar on transportation and storage of spent fuel; Leningrad, USSR (1 Nov 1987).

Marine transport system for spent nuclear fuel shipment from the NPPs in Japan to the reprocessing plants: Tokai (Japan), La Nagne (France) and Sellafield (UK) - is described. Total amount of the uranium transported to the plant Tokai is 375 t, and total amount of foreign transportation of spent fuel from LWR is 1800 t and from GCR is 900 t. Spent fuel from LWR may be transported in the HZ-75 type casks, which contain 7 PWR assemblies or 17 BWR assemblies. Characteristics for the ships 'Hinoura-maru' and 'Pacific Pintail' with dead weight of 1242 t and 3000 t respectively, which may transport four HZ and 4 EXCELLOX casks ('Hinoura-maru') and 17 TN and 24 EXCELLOX casks (/sup P/acific Pin-tail/sup)/, are presented. 3 figs.; 3 tabs.

56216 (INIS-SU—50, pp 5.1-5.21) **Design, fabrication and operational experiences on the HZ-75T spent fuel shipping cask.** Yamada, N. 1987. NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780014/JAW. (CONF-8711209—).

From Japan-USSR seminar on transportation and storage of spent fuel; Leningrad, USSR (1 Nov 1987).

Design and main properties of HZ-75T cask for spent nuclear fuel transportation by road and by sea, are presented. Cask may contain 7 PWR or 17 BWR fuel assemblies. Neutron shielding is made of ethylen glycol and water. Cask body has heat transfer fins designed to dissipate 84 kW of heat. Besides, the possibility of air cooling system for land transport and water cooling system for marine transport is provided. Under development of model the casks were exposed to 9 m drop test. By means of computer calculation codes there were made calculations for stress-strain analysis, thermal calculations of criticality and radiation protection. 27 refs.; 7 figs.; 1 tab.

56217 (INIS-SU—50, pp 6.1-6.26) **Spent fuel storage facility in Japan.** Eizo Shibato. 1987. NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780014/JAW. (CONF-8711209—).

From Japan-USSR seminar on transportation and storage of spent fuel; Leningrad, USSR (1 Nov 1987).

Storage facilities for spent fuel assemblies at BWR and PWR and at reprocessing plants in Japan are described in detail. In case of BWR the storage pool is placed in the reactor building, while at PWR it is placed in the auxiliary building, and fuel pool capacity constitutes 150% of fuel core capacity, as fuel is removed from storage pool after 6 monthes. Recently, NPPs under construction are with storage pool capacity of 300%, and with project capacity of 620% of fuel core. Cooling and cleaning systems for storage pool coolant, racks calculation models, refueling machines and refueling process control are described. Reprocessing plant Tokai is capable of storing 97 t U and to reprocess 210 t U per year. The application of racks made of boron-containing stainless steel will allow increase of storage pool capacity by 30% without storage pool dimensional change. 14 figs.

56218 (SAND—88-2011C) **The contribution of spent fuel shipping cask residual contamination to the transporation source term.** Mings, W.J.; Pauspathi, V.; Sandoval, R.P.; Jordan, H.; Einziger, R.E. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789;AC06-76RL01830;AC07-76ID01570. 6p. (CONF-881011—18). NTIS, PC A02/MF A01. Order Number DE88014970/JAW.

From Joint meeting of the European Nuclear Society and the American Nuclear Society; Washington, DC, USA (30 Oct 1988).

The US Code of Federal Regulations for the packaging and transportation of radioactive material, 10 CFR Part 71, requires that all shipping packages used to transport irradiated reactor fuel in the US be designed, constructed, and prepared for shipment so that: "(1) under the tests specified in Section 71.71 (Normal Conditions of Transport), there be no loss or dispersal of radioactive contents as demonstrated to a sensitivity of 10/sup {minus}6/ A_2 per hour; and (2) under the tests specified in Section 71.73 (Hypothetical Accident Conditions), there be no escape of krypton-85 exceeding 10, 000 Ci in one week and no escape of other radioactive material exceeding a total amount of A_2 in one week." The quantity A_2 is derived from dosimetric models and varies for each nuclide in accordance with its radiotoxicity. 6 refs., 1 tab.

56219 (SAND—88-2340C) **Development of strain gage evaluation channels.** Uncapher, W.L.; Bronowski, D.R.; Stenberg, D.R. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 6p. (TTC—0828; CONF-881174—2). NTIS, PC A02/MF A01. Order Number DE88017350/JAW.

From Experimental mechanics in manufacturing and quality control; Indianapolis, IN, USA (6 Nov 1988).

The Transportation System Development Department at Sandia National Laboratories (SNL) evaluates the structural response of casks being developed to transport radioactive materials. A major part of this activity includes gathering instrumentation data from dynamic impact tests of cask models. These test are performed per the requirements defined in the Code of Federal Regulations 10 CFR 71.73, which includes a 9-m (30-ft) impact onto a flat, unyielding target and a 1-m (40-in.) puncture test onto a 15-cm (6-in.) in diameter puncture probe. The acquisition of reliable, high quality data is an important component of cask certification. One method to estimate the reliability of instrumentation during impact testing is to include evaluation channels for the various transducers (e.g., accelerometers, strain gages) used for measuring the cask structural response. Some accelerometer manufacturers have produced evaluation channels for use in the structural testing of casks. These commercial devices produce very low output, or no output, to applied shock acceleration. There are no commercially available packaged strain gage evaluation channels, however. Consequently, SNL has developed strain gage evaluation channels to estimate unwanted non-strain induced resistance changes that could affect resistance strain measurement data. 3 refs., 1 fig.

0510 Marketing, Economics, And By-products

REFER ALSO TO CITATION(S) 56560

56220 (INIS-mf—11310, pp 48) **NESY-1, NESY-2, NESY-3, NESY-4 - four computer codes to calculate fuel-consistent dynamic fuel cycle scenarios of nuclear power systems.** Lesch, K.H.; Malli, K. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

56221 (INIS-mf—11310, pp 34) **Dynamic analysis of fusion-fission-systems.** Weger, I.; Heindler, M. Apr 1986. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

56222 (INIS-mf—11310, pp 33) **Energy balances in the system fusion breeder - light water reactor.** Weger, I.; Heindler, M.; Hinterkircher, M. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

56223 (INIS-mf—11310, pp 32) **Results of an investigation of nuclear power systems with regard to fuels.** Weger, I.; Hinterkircher, M. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

56224 (INIS-mf—11310, pp 31) **Fast breeders in the nuclear fuel cycle.** Lesch, K.H. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

0520 Waste Management

REFER ALSO TO CITATION(S) 56203, 56207, 56208, 56209, 56217, 56354, 56356, 56538, 56545, 56655, 56717, 56719, 56998, 57025, 57045, 57109, 57128, 57147, 57148, 57149, 57150, 57151, 57153, 57522, 57541, 58334

56225 (BMI/ONWI/C—264) Station, local, and public participation plan, Salt Repository Project Office, Deaf Smith County, Texas: Draft. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Dec 1987. Contract AC02-87CH10290. 135p. H. Order Number TI89000055/JAW.

The purpose of the SRPO State, Local, and Public Participation Plan is to provide an "umbrella" document for the ongoing and planned institutional involvement. One of the major goals is to develop project-specific outreach and participation programs based on input received from interested parties. DOE's commitment to interaction and information programs is to be demonstrated by conducting activities in an open environment, listening to and understanding the concerns of interested parties, actively involving affected parties in the program, executing faithfully the intent of Congress expressed through the NWPA, and providing equitable treatment for all affected parties. 1 fig., 2 tabs.

56226 (BMI/ONWI/C—268) USBM [United States Bureau of Mines] borehole deformation gage absolute stress measurement test procedure: Final draft. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Golder Associates, Inc., Redmond, WA (USA)). Dec 1986. Contract AC02-87CH10290. 76p. H. Order Number TI89000046/JAW.

The technique described herein for determining the magnitudes and directions of the in situ principal stresses utilizes the stress relief in a small volume of rock when it is physically isolated from the surrounding rock mass. Measurements of deformation are related to stress magnitudes through an understanding of the constitutive behavior of the rock. The behaviors of the non-salt strata around the ESF are expected to conform approximately to that of uniform homogeneous linear-elastic materials having either isotropic or transverse isotropic properties, for which constitutive relations are developed. The constitutive behavior of the salt strata is not well understood and so the overcoring technique yields information of only very limited use. For this reason the overcoring technique will not be used in the salt strata. The technique has also limited application in rocks containing joints spaced less than 8 in. (0.2 m) apart, unless a large number of test can be performed to obtain, a good statistical average. However, such unfavorably discontinuous rocks are not expected as a norm at the Deaf Smith County site. 7 refs., 22 figs., 4 tabs.

56227 (BMI/ONWI/C—270) Waste handling building design tradeoff studies: Salt Repository Project closeout task report. (Battelle Memorial Inst., Hereford, TX (USA). Office of Nuclear Waste Isolation). 29 Apr 1988. Contract AC02-87CH10290. 30p. H. Order Number TI89000077/JAW.

The purpose of this closeout study is to capture work done by SRPO contractors and the relevant knowledge and recommendations of Battelle staff regarding design of WHB receiving, storage, hot cell areas, and process logistics. The information and recommendations are based on the latest available studies and prior experience of Battelle personnel at WIPP, INEL, and Hanford facilities. The information is expected to be directly applicable to WHB design work that will be done at Nevada, MRS, or other repository facilities. A perspective showing the various WHB areas and general arrangement is given. This study addresses alternatives associated with the receiving area, the fuel storage areas, the cell arrangements, the failed fuel accommodations, and the process logistics. 16 refs., 2 figs., 5 tabs.

56228 (BMI/ONWI/C—287) Sample and Inventory Management System (SIMS): Systems requirements document: Draft technical report. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). [1988]. Contract AC02-87CH10290. 55p. H. Order Number TI89000073/JAW.

The Sample and Inventory Management System (SIMS) must be developed to permit documentation and control of the geotechnical, environmental, and construction material samples for the site characterization process. System enhancements are necessary to permit planning of high-volume sampling in advance of collection. For drilling materials, preparation of over 1Q6 detailed planning documents must be accommodated using SIMS files. Sufficient level of detail, related to program issues and sample specifications, needs to be incorporated so as to permit the Sample Management function to operate with minimal consultation of hundreds of thousands of ancillary paper records. Documentation of individual Sample Management paper records will be accomplished by the Records Information System (RIS) to increase record quality and eliminate duplicate activities. As proposed, SIMS would maintain two record types, INVENTORY and SAMPLE. INVENTORY would contain data on all materials collected, whether tested or not. SAMPLE would include only materials for which testing was requested. A sample numbering system and depth notation in SIMS answers the mandatory legal requirement for unique identification of records. SAMPLE records must be functional under the current program network schedule by June 13, 1986. A pilot version for testing may be required as early as mid-March or April. INVENTORY must be available October 22, 1985, at the latest. INVENTORY would have significant application on August 18, 1986. 8 refs., 11 figs., 3 tabs.

56229 (BMI/ONWI/C—289) Gas emission study: Draft report (SOW 4.3.5.2). (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Fluor Technology, Inc., Irvine, CA (USA)). Mar 1987. Contract AC02-87CH10290;AC02-83WM46656. 42p. H. Order Number TI89000071/JAW.

The hydrocarbon potential in the Palo Duro Basin is extremely low because of low geothermal temperatures and few source beds. It is doubtful any gas can migrate into the repository horizon because of the inability of salt to maintain open fractures. Groundwater flow in the basin is from west to east which would direct any known occurrences of gas and petroleum away from the repository site. Potential ground water flow through the evaporite section is downward preventing any gas charged deep brines from migrating upward. Gases in salt generally appear to be associated with water in effectively sealed volumes (fluid inclusions). The water content of bedded salt in the Palo Duro Basin has been estimated to range between 0.15 and 2.16%. From this it is estimated gas as methane could occur at a maximum of 0.64 cu. ft per ton of salt. However, only a fraction of this would be released to the repository environment. Little gas is expected to be released upon excavation, but migration of inclusions toward hot canisters and consequent release of gas might occur. 44 refs., 4 figs., 2 tabs.

56230 (BMI/ONWI/C—290) Proceedings of the Joint United States/Federal Republic of Germany Technical Exchange Conferences on Nuclear Waste. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). 1988. Contract AC02-87CH10290. 481p. (CONF-880377—). H. Order Number DE89000062/JAW.

From Joint United States/Federal Republic of Germany technical exchange conference on nuclear package; Albuquerque, NM, USA (8 Mar 1988).

These Proceedings consist of manuscripts and collections of visual materials which were made available by the speakers at the times of presentation. Explanatory paragraphs also are provided, particularly in cases where manuscripts were not available, to indicate the continuity of the meetings. These paragraphs are derived from recordings and/or notes made by the editor and are not intended to be verbatim transcriptions.

56231 (BMI/ONWI/C—293(2)) Documentation for Grants Equal To Tax model: Volume 2, User manual. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Jan 1986. Contract AC02-87CH10290. 51p. H. Order Number TI89000294/JAW.

The Grants Equal To Tax (GETT) model was developed to assist in evaluating the amount of Federal grant monies that would go to State and local jurisdictions as a result of site characterization and repository activities. Because a variety of policy issues are in-

volved in estimating the grant payments, the GETT model is designed to have the flexibility to implement different policy options. The GETT User Manual describes how to run the GETT model and how to modify the data bases. 22 figs.

56232 **(CAPE—3014) Final design report for the Prototypical Consolidation Demonstration Project, Phase 2: Drawings (Engineering Materials).** (Nutech Engineers, Inc., San Jose, CA (USA)). 1987. Contract AC07-86ID12647. 4 H. Order Number TI89000680/JAW.

These drawings accompany Report No. DOE/ID/12647--2-Vols.1-6.

This report documents NUTECH's final design of a dry, spent fuel rod consolidation system. The scope of Phase 2 of the PCDP has resulted in a final design, plus all of the engineering documentation required to demonstrate that the specified design requirements for the system are satisfied by that design. All the details of NUTECH's final design are described in this PCDP Phase 2 final design report. Compliance with the generic functional requirements, the TAN-specific functional requirements, and all applicable codes and standards is documented in this report. Detailed descriptions are provided of all consolidation equipment and support systems, plus the remote operations and maintenance systems. The equipment and operational systems required for decontamination and radioactive waste management, as well as the other facility and operating requirements are discussed in this report. This document provides the PCDP drawing tree. Reference DOE/ID/12647--2-Vols.1-6

56233 **(CEA-CONF—9395) Some applications of melting in a cold crucible.** Boen, R.; Bousquet, F.; Hery, Y.; Jouan, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). 1987. 16p. (In French). (CONF-8709357—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754985/JAW.

From French-Soviet collaboration meeting in the field of reprocessing; Moscow, USSR (15 Sep 1987).

After a brief description of the principle continuous vitrification of fission products in a 200-kW-melter producing 40 kg/hr and melting of can chips from spent fuel elements are examined. A high decontamination factor (DF) from 500 to 5000 is obtained for stainless cladding with different fluxes but because of high reducing properties of Zr DF is low in melting of zircaloy.

56234 **(CEA-CONF—9422) Incineration plant for thermal destruction of radioactive liquid wastes.** Bartoli, B.; Lisbonne, P. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). 1988. 6p. (CONF-880526—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88754987/JAW.

From International conference on incineration of hazardous and radioactive waste; San Francisco, CA, USA (3 May 1988).

Incineration was selected to destroy organic liquids contaminated by radioelements. This treatment offers the advantage of reducing the volume of wastes considerably. Therefore an incineration plant has been built within the nuclear research center of Cadarache. After an experimental work with inactive organic liquids from June 1980 to March 1981, the incineration plant was approved by safety authorities for the incineration of contaminated organic liquids. The capacity ranges from 20l/hr to 50l/hr. On the basis of 6 years of operation and a volume of 200 m3 the incineration plant has shown reliable operating conditions in the destruction of various contaminated organic liquids.

56235 **(CEA-CONF—9430) Capacity of different cements for nitrated effluent conditioning.** Bouniol, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1988. 2p. (In French). (CONF-880510—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88754990/JAW.

From International symposium on the management of low and intermediate level radioactive wastes; Stockholm, Sweden (16 May 1988).

56236 **(CEA-tr—2113) Radionuclide migration in sub-surface soil.** Bachhuber, H.; Bunzl, K.; Dietl, F.; Kretner, R.; Schimmack, W.; Schultz, W. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Mar 1988. 69p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755001/JAW.

The aim of the investigations was to draw the most realistic conclusions about the migration rate of the radionuclides strontium, iodine, cesium and cerium in a model accident contaminating various subsurface soils in the environment of the Gorleben salt dome. The retardation factors of the radionuclides were determined in column tests in undisturbed soil samples. The distribution coefficients were determined in disturbed soil samples by shaking tests (batch method). The following mobility series can be given very approximately for the examined soil profiles where columnar results have been used: Ranker (Trebel) $I > Sr > Ce > Cs$; Podzol (Gorleben) $I > Cs > Sr > Ce$; Braunerde (Bruenkendorf) $I \geqq Sr > Ce \geqq Cs$; Arable Soils: Podzol (Gorleben) $I > Sr \geqq Cs \geqq Ce$; Para braunerde (Eschweiler) $I > Sr \geqq Ce \geqq Cs$.

56237 **(CEA-tr—2219) Kaisten exploration well. Nagra deep drilling program.** (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Sep 1986. 87p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755004/JAW.

The exploration well at Kaisten was realized as the fifth well within the Nagra Deep Drilling Program in Northern Switzerland. The drilling work was started February 13, 1984. Having reached the final depth of 1305.8 m on June 27, 1984, the test phase was initiated and completed by May 3, 1985. The well drilled approx. 300 m of sediments and approx. 1000 m of crystalline rock. Oriented cores were taken over the whole length of the well. The present report presents the drilling activities, civil construction work related to the site and precautions taken to account for environmental protection aspects. A chapter dealing with the commission representing members of the federal, cantonal and local authorities and about reporting is given at the end of this report.

56238 **(CEA-tr—2220) Hydraulic characteristics of a radioactive waste repository groundwater analysis.** (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Sep 1986. 75p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755005/JAW.

This report deals with the deep drilling program executed in northern Switzerland by the National Cooperative for the Storage of Radioactive Wastes (NAGRA). Investigations were aimed at describing geologic conditions with respect to waste disposal. One of the main effort was directed at identifying properties and behaviour of groundwater. Among the activities involved was the collecting of groundwater samples for laboratory investigations. The methods used and experience gained during drilling fluid tracing, water sampling and quality control of extracted groundwater are described. The technical constraints (depth, temperature, borehole diameter) led to the deployment of specialized equipment, parts of which were still at the experimental stage.

56239 **(CONF-871075—31) Evaluation of proposed shallow-land burial sites using the PRESTO-II [Prediction of Radiation Effects from Shallow Trench Operations] methodology and code.** Fields, D.E.; Uslu, I.; Yalcintas, M.G. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01. Order Number DE89000657/JAW.

From 3. Oak Ridge model conference on waste problems; Oak Ridge, TN, USA (13 Oct 1987).

PRESTO-II (Prediction of Radiation Effects from Shallow Trench Operations) is a computer code designed to evaluate possible doses and risks (health effects) from shallow-land burial sites. The model is intended to serve as a non-site-specific screening model for assessing radionuclide transport, ensuing exposure, and health impacts to a static local population for a 1000-year period following the end of disposal operations. Human exposure scenarios include normal releases (including leaching and operational spillage), human intrusion, and limited site farming or reclamation.

Pathways and processes of transport from the trench to an individual or population include ground-water transport, overland flow, erosion, surface water dilution, suspension, atmospheric transport and deposition, inhalation, external exposure, and ingestion of contaminated beef, milk, crops, and water. The proposed waste disposal area in Koteyli, Balikesir, Turkey, has been evaluated using the PRESTO-II methodology. The results have been compared to those obtained for the Barnwell, South Carolina, site. Dose estimates for both sites are below regulatory limits, for the release and exposure scenarios considered. The doses for the sites are comparable, with slightly higher estimates obtained for the Turkish site. 7 refs., 1 tab.

56240 **(CONF-880903—19) Beyond the NIMBY [not-in-my-backyard] impasse II: Public participation in an age of distrust.** Peelle, E. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88011860/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, USA (11 Sep 1988).

With the intensification of not-in-my-backyard (NIMBY) responses to both nuclear and chemical waste management and facility siting, we revisit public participation goals, processes, mechanisms and results to evaluate the uses and limits of public participation for achieving legitimate siting decisions. The deepening loss of trust of the American public in most institutions jeopardizes all preemptive nuclear and hazardous waste facility siting decisions, and carefully structured public participation efforts including some form of power sharing offer the best hope of devising legitimate and durable decisions. We review the key factors in the general siting milieu as well as the thickets of public participation-public involvement. Outcomes of six public participation (PP) case studies are presented and analyzed for problems as well as common factors contributing to their success or failure. The uses as well as the limits of PP in complex nuclear and hazardous waste management and siting processes are considered. 38 refs., 1 tab.

56241 **(CONF-881003—2) Performance assessment monitoring of low-level radioactive waste disposal facilities.** Garland, S.B. II; Craig, P.M.; Styers, D.R. (Oak Ridge National Lab., TN (USA); Environmental Consulting Engineers, Inc., Knoxville, TN (USA); Automated Sciences Group, Inc., Oak Ridge, TN (USA)). 1988. Contract AC05-84OR21400. 20p. NTIS, PC A03/MF A01. Order Number DE89000655/JAW.

From Water Pollution Control Federation conference; Dallas, TX, USA (2 Oct 1988).

To develop a long-range plan for the disposal of the solid low-level radioactive wastes (LLW) generated by these facilities, the Low-Level Waste Disposal Development and Demonstration Program was initiated. A key component of the program is selecting promising disposal technologies to be demonstrated at a scale sufficient to assess performance adequately. One technology selected for demonstration is the aboveground tumulus. The tumulus facility consists of a concrete pad on which the LLW is placed, a synthetic underpad liner, concrete disposal vaults in which the LLW is contained, and a multilayered cap to be constructed after the pad is filled. This paper describes the methodology being used to assess the performance of the tumulus in terms of environmental impacts and worker exposures. This assessment also will assist in determining monitoring needs during routine operations of future full-scale facilities.

56242 **(CONF-881011—24) Doses to railroad workers from shipments of radioactive materials.** Fields, D.E.; Cottrell, W.D. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01. Order Number DE88017359/JAW.

From Joint meeting of the European Nuclear Society and the American Nuclear Society; Washington, DC, USA (30 Oct 1988).

Fissile and high-level radioactive wastes are currently transported over long distances by truck and by rail transportation systems. The primary form of fissile material is spent reactor fuel. Transportation operations within DOE are controlled through the Transportation Operations and Management System. DOE projected increases in the rate of shipments have generated concern by railroad companies that railroad workers may be exposed to levels of radiation sufficiently high that a radiation protection program may need to be implemented. To address railroad company concerns, the Health and Safety Research Division at Oak Ridge National Laboratory has estimated doses to railroad workers for two exposure scenarios that were constructed using worker activity data obtained from CSX Transportation for crew and maintenance workers. This characterization of railroad worker activity patterns includes a quantitative evaluation of the duration and rate of exposure. These duration and exposure rate values were evaluated using each of three exposure rate vs. distance models to generate exposure estimates. 14 refs., 1 tab.

56243 **(CONF-881054—7) Data and Information Management System for the ORNL Remedial Action Program.** Voorhees, L.D.; Hook, L.A.; Gentry, M.J.; Owen, P.T.; Newman, K.A.; McCord, R.A.; Faulkner, M.A.; Bledsoe, J.L. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 23p. NTIS, PC A03/MF A01. Order Number DE89000642/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

A Remedial Action Program (RAP) was established in FY 1985 at Oak Ridge National Laboratory (ORNL) to provide corrective measures at areas contaminated with radioactive and/or hazardous chemical wastes. To achieve this goal, numerous and varied studies are being conducted to characterize the waste disposal sites. Environmental data collected in support of other programs at ORNL are also of use to RAP. Collectively, these studies are generating a voluminous amount of data on a scale unprecedented for ORNL. A computerized Data and Information Management System (DIMS) was developed to (1) provide a centralized repository for data pertinent to RAP and (2) provide support for the investigations and assessments leading to the long-term remediation of contaminated sites and facilities. The current DIMS and its role in supporting RAP are described. The DIMS consists of three components: (1) the Bibliographic Data Base, (2) the Records Control Data Base, and (3) the Numeric Data Base. This paper/poster emphasizes the Numeric Data Base, including its development and organization, and also summarizes the status of other activities associated with management and use of such data (i.e., bibliographic information, records control, geographic information, and quality assurance). The types of data currently available have been summarized, and a synopsis of the contents of the RAP numeric data base has been compiled in a menu-driven program available on PC diskettes. The synopsis will be demonstrated at the conference. 4 refs., 5 figs.

56244 **(CONF-881054—8) A pioneering application of NQA-1 quality assurance standards in the development of software.** Weisbin, A.N. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01. Order Number DE89000641/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

One reason for systematically applying quality assurance to computer software is the extensive use of results from computer programs to characterize potential sited for nuclear waste repositories leading ultimately to important policy making decisions. Because data from these programs characterize the likely radioactivity profile for many hundreds of years, experimental validation is not feasible. The Sensitivity and Uncertainty Analysis Methods Development Project (SUAMDP) was developed to formulate and utilize efficient and comprehensive methods for determining sensitivities of calculated results with respect to changes in all input parameters. The computerized methodology was embodied in the Gradient Enhanced Software System (GRESS). Due to the fact that GRESS was to be used in the site characterization for waste storage, stringent NQA-1 requirements were imposed by the sponsor. A working relationship between the Oak Ridge National Laboratory (ORNL) Quality Department and the research scientists developing GRESS was essential in achieving understanding and acceptance of the quality assurance requirements as applied to the SUAMDP. The relationship resulted in the SUAMDP becoming the first software project at ORNL to develop a comprehensive NQA-1 Quality Assurance Plan; this plan now serves as a model for software qual-

ity assurance at ORNL. This paper describes the evolution of this plan and its impact on the application of quality assurance procedures to software. 2 refs.

56245 **(CONF-881054—12) Survey of computer codes applicable to waste facility performance evaluations.** Alsharif, M.; Pung, D.L.; Rivera, A.L.; Dole, L.R. (PAI Corp., Oak Ridge, TN (USA); Oak Ridge National Lab., TN (USA); Qualtech, Inc., Oak Ridge, TN (USA)). 1988. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01. Order Number DE89001192/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

This study is an effort to review existing information that is useful to develop an integrated model for predicting the performance of a radioactive waste facility. A summary description of 162 computer codes is given. The identified computer programs address the performance of waste packages, waste transport and equilibrium geochemistry, hydrological processes in unsaturated and saturated zones, and general waste facility performance assessment. Some programs also deal with thermal analysis, structural analysis, and special purposes. A number of these computer programs are being used by the US Department of Energy, the US Nuclear Regulatory Commission, and their contractors to analyze various aspects of waste package performance. Fifty-five of these codes were identified as being potentially useful on the analysis of low-level radioactive waste facilities located above the water table. The code summaries include authors, identification data, model types, and pertinent references. 14 refs., 5 tabs.

56246 **(CONF-881054—13) Optimizing compliance training for the waste management worker.** Copenhaver, E.D. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01. Order Number DE89001211/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

Waste management workers are required to participate in special training mandated by a variety of Federal laws and DOE Orders; these include the Resource Conservation and Recovery Act (RCRA), Superfund Amendments Reauthorization Act (SARA) as implemented by OSHA in CFR 1920.120, in addition to requirements for Hazard Communication, Radiation Workers, Respiratory Protection, Transportation, and Waste Generator training. The Technical Resources and Training program is examining the course contents and mandated requirements to determine how to best meld these requirements into a training program that will still fulfill all requirements but eliminate the potential for duplication of some elements in successive courses. This approach may not eliminate all duplication between courses, but it should result in significant savings in manhours demanded in a training environment which requires similar information to meet a host of regulatory requirements. The training matrix planned for Oak Ridge National Laboratory (ORNL) will be presented and discussed. 22 refs., 3 tabs.

56247 **(CONF-881054—16) Disposal/storage container development experience.** Morrow, R.W. Jr.; Van Hoesen, S.D.; Fowler, E.; Barreira, D.G.; Emmett, R.W. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01. Order Number DE89001520/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

Developmental work is currently underway at the Oak Ridge National Laboratory to design and manufacture a radioactive waste container suitable for both storage and disposal of radioactive wastes. The container is designed to fulfill the Department of Energy and Nuclear Regulatory Commission requirements for on-site storage, as well as the Nuclear Regulatory Commission's requirements for high integrity containers. The project also involves meeting the strict design and manufacturing ANSI/ASME NQA-1 guidelines. Special provisions of the container include a double containment system, with the inner barrier being corrosion resistant, the capability to monitor the internal cavity of the container, and off-gas venting capability. Further, yet related developmental work includes evaluating the cask for other varied uses, such as a processing cask, an ALARA shield, and even the possibility of Department of Transportation approval for an over-the-road transport cask.

56248 **(CONF-881054—17) HAZWDDD [Hazardous Waste Development, Demonstration, and Disposal]: An exercise in corporate planning.** McGinnis, C.P.; Pechin, W.H. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01. Order Number DE89001491/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

Both Energy Systems corporate management and US Department of Energy's Oak Ridge Operations Office (DOE-ORO) management have recognized the seriousness of these problems and have established several programs to determine acceptable courses of action. A plan has been developed for low-level radioactive waste (LLW), and an active dialogue pertaining to LLW is maintained with the state and federal regulators. During 1986, DOE-ORO and Energy Systems identified the need for a plan to address hazardous and mixed wastes. Each installation supports the concept of HAZWDDD through funding and the development of individual HAZWDDD implementation plans. A corporate plan is being developed to integrate the issues discussed in the five installation plans. This paper describes the approach taken in collecting the necessary information for the plan, some of the techniques used in analyzing the information provided, preliminary data that have been collected in preparation of this plan, the identification of common concerns and issues, and the integration of this information into a corporate approach to mixed and hazardous waste management. 1 fig., 5 tabs.

56249 **(CONF-881077—7) Department of Energy Hazardous Waste Remedial Actions Program: An overview.** Eyman, L.D.; Swiger, R.F. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01. Order Number DE88015283/JAW.

From 15. annual national Energy Division conference; San Antonio, TX, USA (23 Oct 1988).

This paper describes the national Department of Energy (DOE) program for managing hazardous waste. An overview of the DOE Hazardous Waste Remedial Actions Program (HAZWRAP), including its mission, organizational structure, and major program elements, is given. The paper focuses on the contractor support role assigned to Martin Marietta Energy Systems, Inc., through the establishment of the HAZWRAP Support Contractor Office (SCO). The major SCO programs are described, and the organization for managing the programs is discussed. The HAZWRAP SCO approaches to waste management planning and to technology research, development, and demonstration are presented. The role of the SCO in the DOE Environmental Restoration Program and the development of the DOE Waste Information network are reviewed. Also discussed is the DOE Work for Others Program, where waste management decentralized support, via interagency agreements between DOE and the Department of Defense and DOE and the Environmental Protection Agency, is provided for those sponsors planning remedial response actions. 2 refs.

56250 **(CORR—870116) Ecologic assessment of closure options for Savannah River Plant waste sites.** (Science Applications International Corp., Oak Ridge, TN (USA)). 17 Apr 1987. Contract AC09-76SR00001. 340p. (SAIC—87/1645). NTIS, PC A15/MF A01. Order Number DE89001425/JAW.

The report contains ecologic analyses of closure options for each of 26 functional groups of waste sites at SRP. Some of these waste sites have historically received hazardous, radioactive, or mixed wastes. SRP has been a designated National Environmental Research Park since 1972. In addition, the effect of 30 years of restricted public access has been to make the SRP, in a sense, a wildlife refuge. Contemporaneously with restricted access and production of strategic nuclear materials, there have been increases in wildlife populations, extensive pine planting, and return of formerly agricultural land to natural succession. In preparing this report, Science Applications International Corporation (SAIC) utilized data for contaminants in groundwater, surface waters, basin sediments,

and waste site soils collected by various contractors and provided by du Pont. In addition, the ecologic assessments are based upon PATHRAE ground water transport modeling performed by Rogers and Associates Engineering, and a stream dilution modeling methodology adopted by du Pont. SAIC did not perform field work in the course of the assessment, but did visit the major sites for cursory visual inspection and examined aerial photographs of waste sites and surrounding terrain. 111 refs., 22 figs., 163 tabs.

56251 **(DOE/DP/48025—T1) PATRAM '89 Administrative Plan.** (USDOE Assistant Secretary for Defense Programs, Washington, DC. Transportation Management Div.). 11 Jul 1988. Contract AC01-85DP48025. 49p. NTIS, PC A03/MF A01. Order Number DE89001560/JAW.

PATRAM is an acronym for Packaging and Transportation of Radioactive Materials. The purpose of these symposia is to bring together, on an international basis, representative experts from industry, government, and research organizations to exchange scientific and technical information relating to all aspects of the packaging, testing, and transporting of radioactive materials. Through the sustained excellence of their programs, these symposia have become the premier domestic and international forums for this purpose in this increasingly important scientific field. PATRAM is the only symposia in the world that is devoted entirely to this subject.

56252 **(DOE/ID/12584—10) Procedures, analysis, and comparison of groundwater velocity measurement methods for unconfined aquifers.** Kearl, P.M.; Dexter, J.J.; Price, J.E. (UNC Geotech, Grand Junction, CO (USA)). Sep 1988. Contract AC07-86ID12584. 54p. (UNC/GJ-TMC—3). NTIS, PC A04/MF A01. Order Number DE89001067/JAW.

Six methods for determining the average linear velocity of ground- water were tested at two separate field sites. The methods tested include bail tests, pumping tests, wave propagation, tracer tests, Geoflo Meter{reg←sign}, and borehole dilution. This report presents procedures for performing field tests and compares the results of each method on the basis of application, cost, and accuracy. Comparisons of methods to determine the ground-water velocity at two field sites show certain methods yield similar results while other methods measure significantly different values. The literature clearly supports the reliability of pumping tests for determining hydraulic conductivity. Results of this investigation support this finding. Pumping tests, however, are limited because they measure an average hydraulic conductivity which is only representative of the aquifer within the radius of influence. Bail tests are easy and inexpensive to perform. If the tests are conducted on the majority of wells at a hazardous waste site, then the heterogeneity of the site aquifer can be assessed. However, comparisons of bail-test results with pumping-test and tracer-test results indicate that the accuracy of the method is questionable. Consequently, the principal recommendation of this investigation, based on cost and reliability of the ground-water velocity measurement methods, is that bail tests should be performed on all or a majority of monitoring wells at a site to determine the "relative" hydraulic conductivities.

56253 **(DOE/ID/12584—28) Supplement to procedures, analysis, and comparison of groundwater velocity measurement methods for unconfined aquifers.** Zinkl, R.J.; Kearl, P.M. (UNC Geotech, Grand Junction, CO (USA)). Sep 1988. Contract AC07-86ID12584. 82p. (UNC/GJ-TMC—4). NTIS, PC A05/MF A01. Order Number DE89001064/JAW.

This report is a supplement to Procedures, Analysis, and Comparison of Groundwater Velocity Measurement Methods for Unconfined Aquifers and provides computer program descriptions, type curves, and calculations for the analysis of field data in determining groundwater velocity in unconfined aquifers. The computer programs analyze bail or slug tests, pumping tests, Geoflo Meter data, and borehole dilution data. Appendix A is a description of the code, instructions for using the code, an example data file, and the calculated results to allow checking the code after installation on the user's computer. Calculations, development of formulas, and correction factors for the various programs are presented in Appendices B through F. Appendix G provides a procedure for calculating transmissivity and specific yield for pumping tests performed in unconfined aquifers.

56254 **(DP—1767) Rhizotron and field test of a root biobarrier technique: Methods and first year results.** Murphy, C.E. Jr.; Adriano, D.C.; Corey, J.C.; Kaplan, D.I.; Harrelson, J.L.; Decker, O.D.; Griggs, R.D. (Savannah River Lab., Aiken, SC (USA)). Aug 1988. Contract AC09-76SR00001. 31p. NTIS, PC A03/MF A01. Order Number DE89000635/JAW.

Vegetation is commonly used to stabilize the ground covering buried waste sites. However, constituents of buried waste can be brought to the surface if the waste is penetrated by plant roots. An ideal waste burial system would allow the use of vegetation to stabilize the soil above the buried waste but would exclude roots from the waste. One system which shows promise of accomplishing this objective is a root biobarrier. The biobarrier consists of a slow release encapsulation of a root growth inhibitor (Trifluralin). The capsules are bounded on a geofabric sheet. Tests were conducted in a rhizotron and in the glass walled trenches in the field to observe the effect of the root biobarrier on the growth of a variety of plant species. The preliminary results indicate that roots of soybean [Glycine max (L). Merr.] and Bermuda grass [Cynodon dactylon (L). Pers.] do not grow within one inch of the barrier. Analysis of the level of root inhibitor in the soil confirms that the concentration of inhibitor near the biobarrier is high enough to stop root growth. If further tests continue to show that the biobarrier can exclude roots for extended periods of time it appears the biobarrier should be considered for inclusion in buried waste systems. 6 refs., 15 figs., 1 tab.

56255 **(DPST—86-443) Hot corrosion of Inconel 690 in DWPF melter: Recommendation for design change to melter lid heaters.** Bickford, D.F. (Savannah River Lab., Aiken, SC (USA)). 23 May 1986. Contract AC09-76SR00001. 37p. NTIS, PC A03/MF A01. Order Number DE89001641/JAW.

The attached report discusses the potential for high-temperature corrosion of Inconel 690 in the DWPF melter. Based upon this work, we have concluded that minor design modifications to the DWPF lid heaters are desirable. In particular, the gap between the lid heaters and the refractory where the heaters penetrate the melter shell should be sealed. This will reduce condensation of salts in this area, and improve the sulfidation resistance of the melter. It is expected that heat transfer calculations will be necessary to prevent overheating the lid heaters in this area. 21 refs., 6 tabs., 14 figs.

56256 **(DPST—86-527) Rheology of melts containing crystalline material.** Plodinec, M.J. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 27 Jun 1986. Contract AC09-76SR00001. 10p. NTIS, PC A02/MF A01. Order Number DE89001409/JAW.

During vitrification of SRP waste in the Defense Waste Processing Facility (DWPF), there will be occasional errors in preparing the feed. If the error in feed preparation results in sludge concentrations which exceed the solubility of the waste material in the glass melt, formation of crystalline material will occur. As discussed below, approximately in the DWPF melter over a two-year campaign. In this report, the effects of this crystalline material on the properties of the melt, in particular on the rheological properties, are examined. The major concentration of the work is that, in those cases in which crystalline material precipitates from the melt, the changes in melt rheology induced by the presence of crystalline material will make draining the melter (e.g. at the end of the melter's life) more difficult. Methods to improve the rheology of the melt are suggested. 6 refs., 3 figs., 3 tabs.

56257 **(DPST—86-745) DWPF glass redox determination: Summary of results from Clemson subcontract.** Jantzen, C.M. (Savannah River Lab., Aiken, SC (USA)). 29 Oct 1986. Contract AC09-76SR00001. 32p. NTIS, PC A03/MF A01. Order Number DE89001419/JAW.

Development of a rapid and reliable method for glass redox determination is needed for DWPF. Glass redox is important to melter and cold cap chemistry: reducing conditions limit glass foaming and devitrification but overly reducing conditions may cause metallic species to form in the melt which could agglomerate and settle to the floor of the melter. Two analytic techniques for

glass redox made from the DWPF feed are being investigated: Mossbauer spectroscopy which may be subject to interference from the radiation in actual waste and a rapid and simple dissolution/chemical technique. The wet chemical techniques are also necessary in order to calibrate the Mossbauer spectra. Determination of Savannah River waste glass redox by Mossbauer spectroscopy and wet chemical techniques has been examined at Clemson University. The study involves experimental evaluation of wet chemical techniques, experimental determination of Fe^{2+}/Fe^{3+} ratios by Mossbauer spectroscopy, and comparison of the Fe^{2+}/Fe^{3+} ratios determined by the various techniques. The progress of all three phases is summarized in this report. The details of the first phase are given in the attached report. 26 refs., 6 figs., 3 tabs.

56258 (DPST—86-766) Water soluble decontamination coating for Defense Waste Processing Facility (DWPF) canisters. Selby, C.L. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 17 Dec 1986. Contract AC09-76SR00001. 5p. NTIS, PC A02/MF A01. Order Number DE89001406/JAW.

Water soluble sodium borate glass coating was successfully codeveloped by Clemson University (Dr. H.G. Lefort) and Du Pont as an alternative decontamination process to frit slurry blasting of Defense Waste Processing Facility (DWPF) canisters. Slurry blasting requires transport of abrasive slurries, might cause galling by entrapped frit particles, and could result in frit slurry freezeup in pumps and retention basins. Contamination can be removed from precoated canisters with a gentle hot water rinse. Glass waste spilled on a coated canister will spall off spontaneously during canister cooling. A glass coating appears to prevent transfer of contamination to the Canister Decontamination Cell (CDC) guides and cradle. 1 ref., 5 tabs.

56259 (DPST—86-770) Post test inspection of the experimental canister frit blaster. Harris, A.H. (Savannah River Lab., Aiken, SC (USA)). 20 Oct 1986. Contract AC09-76SR00001. 7p. NTIS, PC A02/MF A01. Order Number DE89001423/JAW.

The Experimental Canister Frit Blaster (ECFB) was operated for approximately fifteen months during which time it blasted eighteen full-size canisters. Results of the post test inspection revealed that the ECFB experienced minimal wear during its operation. The recirculation pump operated for 4800 hours pumping mostly 8 wt % frit slurry. A repeat performance test showed that the total dynamic head dropped only 3.2% at the normal operating flow of 400 gallons per minute. The manufacturer estimated the pump life to be 9000 hours with this type service. The chamber sump and the recirculation pipe were also exposed to the frit slurry for about 4800 hours. Thickness test of these items indicated that the erosion due the slurry was less than 0.020". The Canister manipulating Mechanism experienced approximately fifty full cycles of operation. It was determined to be in good condition overall. No conclusive data was found that could be used to estimate its useful life. 5 figs.

56260 (DPST—86-825) Ashcrete technical overview. Schuler, T.F. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 9 Dec 1986. Contract AC09-76SR00001. 9p. NTIS, PC A02. Order Number DE89001420/JAW.

Commercially available ash solidification units use a variety of mixing techniques to stabilize wasteforms. Units vary in processing method, mixing action, batch size, and degree of operator interaction. The Ashcrete unit remotely solidifies incinerator ash using a tumble mixing cycle. Product integrity and process reliability tests were successful in demonstrating the viability of this process. Additional modifications to this design would enhance the unit's remote capability and should be considered for future solidification processes. 2 figs., 1 tab.

56261 (DPST—87-226) Results from the PATRAN lidheater model. Nash, C.A. (Savannah River Lab., Aiken, SC (USA)). 20 Jan 1987. Contract AC09-76SR00001. 9p. NTIS, PC A02/MF A01. Order Number DE89001639/JAW.

SRL recommended that the gaps between the leads of the DWPF electric lidheaters and the refractory through which they pass be sealed to prevent corrosion. This caused concern about possible overheating of the leads which may cause creeping or melting of the Inconel. It is desired to keep all parts of each lidheater at 950{degree}C or below so that the lidheaters do not creep significantly under their own weight during the lifetime of the melter. A PATRAN hat transfer model was created to simulate the problem and possible solutions. The model demonstrated that the revised design of the DWPF lidheaters with packing and a Nickel 200 core will give the most desirable temperature profiles. 5 refs., 6 figs.

56262 (DPST—87-230) Costs of compliance. Plodinec, M.J. (Savannah River Lab., Aiken, SC (USA)). 20 Jan 1987. Contract AC09-76SR00001. 8p. NTIS, PC A02/MF A01. Order Number DE89001640/JAW.

The Department of Energy (DOE) has developed a Waste Acceptance Process which will provide assurance of the acceptability of the DWPF product. The important parts of this process are the development of specifications; the formulation of plans for compliance; and the demonstration of compliance.

56263 (DPST—87-248) Alternative waste form characterization data. Jantzen, C.M. (Savannah River Lab., Aiken, SC (USA)). 27 Jan 1987. Contract AC09-76SR00001. 5p. NTIS, PC A02/MF A01. Order Number DE89001402/JAW.

Seven candidate waste forms were developed between 1979 and 1982 under the direction of the Department of Energy's National High-Level Waste (HLW) Technology Program. The waste forms were evaluated as potential media for the immobilization and geologic disposal of high-level nuclear wastes. The evaluation combined preliminary waste form evaluations conducted by Savannah River Laboratory, by the alterative waste form developers, and by the Material Characterization Center (MCC). Peer review assessments, a product performance evaluation, and a processability analysis were also conducted. This report documents the characterization data provided by Savannah River Laboratory, by the waste form developers, and by the Material Characterization Center (MCC). 17 refs., 1 tab.

56264 (DPST—87-255) Equivalence of wrought and cast stainless steel Defense Waste Processing Facility (DWPF) canisters. Selby, C.L.; Rankin, W.N. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 15 Sep 1987. Contract AC09-76SR00001. 5p. NTIS, PC A02/MF A01. Order Number DE89001404/JAW.

A multi-site study concluded that DWPF canisters with cylindrical surfaces made of centrifugally cast Type 304L stainless steel are equivalent in metallurgical properties, including corrosion resistance, to the reference wrought stainless. The top and bottom of the cast canisters are wrought stainless, identical to the reference canisters. Both passed drop tests. These results indicate that the composite canister meets all process and storage criteria as well as the reference canister. The fabrication choice may be based on cost. 5 refs., 5 tabs.

56265 (DPST—87-532) Summary of campaigns SGM-6 and SGM-7 of the DWPF scale glass melter. Guidotti, P.D.; Crow, K.R.; Weisman, A.F.; Baron, M.R.; Wehner, A.M.; Voogd, J.A.; Smith, M.E.; Goudelock, S.L.; Griffin, G.A.; Shuford, J.A.; O'Rourke, J.M. (Savannah River Lab., Aiken, SC (USA)). 11 Sep 1987. Contract AC09-76SR00001. 109p. NTIS, PC A06/MF A01. Order Number DE89000479/JAW.

The sixth and seventh campaigns of the DWPF Scale Glass Melter have been completed. Simulated precipitate hydrolysis aqueous product was incorporated in the slurry for both campaigns. The feed for the sixth campaign consisted of frit 200/coupled feed with HAN aqueous. The feed for the seventh campaign consisted of frit 200 plus frit 168/coupled feed. The total glass production for both was 51,500 lbs. Primary objectives of the campaigns were to study the effect of organic compounds on the melter system performance and evaluate the effects of riser head insulation and a pour spout modification on glass pouring. This report includes detailed discussions of feed system performance, glass melting and pouring, off-gas treatment, sampling techniques, and instrumenta-

tion. Most of the results are applicable to DWPF. 11 refs., 79 figs., 27 tabs.

56266 **(DPST—87-722) Research melter steady state operation.** Carter, J.T. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 25 Sep 1987. Contract AC09-76SR00001. 21p. NTIS, PC A03/MF A01. Order Number DE88016067/JAW.

Current program objectives for the 774-A Research Melter includes a frit selection study for sludge/precipitate feeds, a feed composition variability study to determine the acceptable operating window for the glass product and process, and a study to characterize the effects of noble metals on melter operation. These objects require evaluation of both processing factors and glass quality (durability). Recent Research Melter campaigns have demonstrated continuous steady state operation. The last two campaigns produced continuous feeding periods lasting 17 and 42 hours, respectively. Several equipment modifications were required to achieve this goal. The equipment changes and both steady state runs are described in this paper. 6 refs., 7 figs., 5 tabs.

56267 **(DPST—88-229) Sampling and analysis of surface water in the vicinity of the F- and H- area seepage basins.** Looney, B.B.; Cantrell, J.E.; Cook, J.R. (Savannah River Lab., Aiken, SC (USA)). 19 Jan 1988. Contract AC09-76SR00001. 25p. NTIS, PC A03/MF A01. Order Number DE89001647/JAW.

Observations from the wetlands downgradient of the F-Area and H-Area Seepage Basins suggest that the water cropping out along the seep line is impacting a small area of the terrestrial/wetlands environment along Four Mile Creek. The primary source of the water in these areas, as well as dissolved constituents in this water, are the seepage basins. The seepage basins have received large volumes of dilute liquid wastewater since the late 1950's. The primary dissolved constituents in the wastewater are hydrogen ion (low pH), nitrate and sodium. The wastewater also contains relatively low concentrations of other chemical constituents (e.g., lead and mercury). The radioactive constituent with the highest activity in the wastewater is tritium; other relatively mobile radionuclides in the wastewater include ^{90}Sr, ^{99}Tc, ^{129}I, and ^{237}Np. 7 refs., 1 fig., 5 tabs.

56268 **(DPST—88-268) Safety review of the DCS [Distributed Control System] controlled full scale SRAT/SME [Sludge Receipt Adjustment Tank/Slurry Mix Evaporator] for water runs.** Hacker, B.A. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 29 Jan 1988. Contract AC09-76SR00001. 6p. NTIS, PC A02/MF A01. Order Number DE89000012/JAW.

This memorandum addresses safety concerns of the Full Scale Sludge Receipt Adjustment Tank/Slurry Mix Evaporator (SRAT/SME) resulting from the installation of the new Distributed Control System (DCS). The present configuration of the SRAT/SME with DCS has been determined to be safe for operational testing with water. Another memorandum will be written after experience has been gained during water runs for actual operation. Previous safety evaluations and process hazard reviews for this facility have addressed normal industrial safety hazards and hazards associated with formic acid handling and operation with organics in the feed. Process operation with the new DCS controls will be very similar to the earlier operation controlled by the Modicon programmable logic controller (PLC). The interlocks for the SRAT/SME that were in the PLC have been programmed into the new DCS and will be reviewed here. 6 refs.

56269 **(DPST—88-630) Safe handling of Defense Waste Processing Facility (DWPF) canisters.** Yau, W.W.F. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 16 Jun 1988. Contract AC09-76SR00001. 4p. NTIS, PC A02/MF A01. Order Number DE89001403/JAW.

The Waste Acceptance Preliminary Specifications (WAPS) call for inclusion in the Waste Form Compliance Plan of information concerning the structural safety of the glass canisters while they are being handled in the Defense Waste Processing Facility (DWPF). This memorandum serves to fulfill such requirements by providing (1) a description of the lifting and transportation process, (2) an assessment of stress states of the canister, and (3) the factors of safety or limitations of the canister design with respect to the process loading. 4 refs.

56270 **(DPSTD—87-3-Rev.1) Plutonium-239 Recovery Incinerator: Technical data summary.** Williams, S. (Savannah River Lab., Aiken, SC (USA)). Apr 1987. Contract AC09-76SR00001. 23p. NTIS, PC A03/MF A01. Order Number DE89000018/JAW.

FB-Line generates an average of 1300 ft^3 of combustible cabinet waste per year, which contain up to 30 kg of Pu-239. Also generated is waste that is not certifiable for shipment to the Waste Isolation Pilot Plant (WIPP). Phase IV of FB-Line Productivity Retention Project will install a waste handling facility to process combustible and noncombustible waste. The Plutonium-239 Recovery Incinerator (PRI) is being designed to process the high activity fraction of the combustible waste. Also, it will be able to incinerate at least part of the non-certifiable waste. The PRI will burn waste in a steam atmosphere, which allows combustion at temperatures less than 700{degree}C to produce dissoluble ash amenable to Pu recovery by dissolution. 6 refs., 8 figs., 3 tabs.

56271 **(EPRI-NP—5977) Radwaste radiolytic gas generation literature review: Final report.** Palmer, C.R. (Electric Power Research Inst., Palo Alto, CA (USA); Sargent and Lundy, Chicago, IL (USA)). Sep 1988. 40p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89000561/JAW.

This report presents the results of a literature review on radiolytic gas generation from Low-Level Radioactive Waste (LLRW) and includes an annotated bibliography of 37 references on the subject. The review shows that hydrogen is the only combustible radiolytic gas that is generated in sufficient quantities to be of concern. Water is consistently the major constituent of LLRW that produces radiolytic hydrogen. Examination of typical PWR and BWR waste streams indicates that most of the waste generated by utilities can be categorically excluded from concern with respect to hydrogen generation. 37 refs., 2 figs., 4 tabs.

56272 **(EPRI-NP—5992-CCM) VRTECH/PC-II User's Manual: Volume-reduction Technology Computer Program.** Nalbandian, J.Y.; Giuffre, M.S.; Koplik, C.M. (Electric Power Research Inst., Palo Alto, CA (USA); Analytic Sciences Corp., Reading, MA (USA)). Sep 1988. 118p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89000253/JAW.

VRTECH/PC II is a microcomputer program written in IBM's Professional FORTRAN for the IBM PC, XT, or AT with at least 512K pay back, and sensitivity analysis for low-level radioactive waste processing systems. VRTECH/PC generates cost reports by low-level waste stream, volume-reduction technologies, storage times, transportation distances, and burial charges. Its top-down, modular design provides flexible software which can be easily modified for the user's specific problem. In addition, VRTECH/PC includes TASC's Screen Generation Facility (SCF) software. SCF provides a user-friendly environment for creating saving and recalling inputs for the proper operation of the program. VRTECH/PC was developed by the Analytic Sciences Corporation, Reading, Massachusetts under contract to the Electric Power Research Institute, Palo Alto, California. 9 refs., 35 figs., 14 tabs.

56273 **(FMPC—2145) Development of a formal waste minimization program at the Feed Materials Production Center.** Harmon, J.E. (Westinghouse Materials Co. of Ohio, Cincinnati (USA). Feed Materials Production Center). 1988. Contract AC05-86OR21600. 11p. (CONF-881054—3). NTIS, PC A03/MF A01. Order Number DE89000297/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

The Feed Materials Production Center (FMPC), a Department of Energy (DOE) facility operated by the Westinghouse Materials Company of Ohio (WMCO), produces uranium metal from various feed materials for DOE defense programs. Large quantities

of low level waste along with smaller amounts of hazardous and mixed wastes are generated during routine operations and construction activities. As part of an effort to manage these wastes in the most environmentally sound and cost effective way, Westinghouse made a step towards establishing a formal waste minimization program in fiscal year 1988. This involved the development of "The FMPC Waste Minimization Plan." This paper summarizes the contents of that plan and some of the aspects of its implementation. 4 refs., 1 fig. 1 tab.

56274 **(GSF—6/88) Brine migration test - Asse salt mine, Federal Republic of Germany. Final report.** Rothfuchs, T.; Wieczorek, K.; Feddersen, H.K.; Staupendahl, G.; Coyle, A.J.; Kalia, H.; Eckert, J. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Remlingen (Germany, F.R.). Inst. fuer Tieflagerung; Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Mar 1988. 324p. (GSF-TL—1/88). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88755282/JAW.

This document is the final report on the Cooperative German-American 'Brine Migration Tests' that were performed at the Asse Salt Mine in the Federal Republic of Germany (FRG), the Office of Nuclear Waste Isolation (ONWI), Columbus, Ohio, and the Institut fuer Tieflagerung (IfT), Braunschweig, of the Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen (GSF). Final test and equipment design as well as manufacturing and installation was carried out by Westinghouse Electric Corporation. The tests were designed to simulate a nuclear waste repository to measure the effects of heat and gamma radiation on brine migration, salt decrepitation, disassociation of brine, and gases collected. The thermal mechanical behavior of salt, such as room closure, stresses and changes of the properties of salt are measured and compared with predicted behavior. The performance of an array of candidate waste package materials, test equipment and procedures under repository conditions will be evaluated with a view towards future in-depth testing of potential repository sites.

56275 **(INFO—0179) Oklo natural reactors: geological and geochemical conditions. A review.** Jakubick, A.T.; Church, W. (Ontario Hydro Research Lab., Toronto (Canada); University of Western Ontario, London (Canada). Dept. of Geology). (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Feb 1986. 59p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88703549/JAW.

Annotated bibliography.

Published as well as unpublished material on the Oklo natural reactors in Gabon was evaluated with regard to the long-term aspects of nuclear waste disposal. Even though the vast data base available at present can provide only a site specific description of the phenomenon, already this material gives relevant information on plutonium retention, metamictization, fission product release, hydrogeochemical stability and migration of fission products. Generalized conclusions applicable to other nuclear waste repository would require the quantitative reconstruction of t s coupled thermo-hydrologic-chemical processes. This could be achieved by studying the deviations in the /sup 2/H//sup 1/H and /sup 18/O//sup 16/O ratios of minerals at Oklo. A further generalization of the findings from Oklo could be realized by examining the newly-discovered reactor zone 10, which was active under very different thermal conditions than the other reactors. 205 refs.

56276 (INIS-mf—11311, pp 19) **Determination of the tritium exhalation of radioactive wastes by means of the electret ionization chamber.** Pretzsch, G.; Herzog, C.; Schneider, L. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik; Institut fuer Energetik, Dresden (German Democratic Republic)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

56277 **(INIS-mf—11800) Konrad mine - from ore mine to radwaste final storage site.** Viehl, E. (ed.). (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.); Physikalisch-Technische Bundesanstalt - Inst. Berlin (Germany, F.R.)). 1987. 57p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755165/JAW.

After the production of ore had been abandoned in October 1976 for reasons of profitability, the suitability of the pit 'Konrad' for the final storage of radioactive wastes was investigated. After the conclusion of these investigations which were carried out from 1976 to 1982, the PTB (Federal Institute for Physics and Technology) applied for the introduction of a plan approval procedure for final storage in 1982. In the case of a favourable result of the plan approval procedure, the final storage of radioactive wastes will be started in 1991/92. With the preparation of the plan for the pit 'Konrad', the safety of final storage for all kinds of radioactive wastes with negligible heat development was proved under operating conditions, long-term conditions and emergency conditions. This brochure gives a survey of the project. (orig./HSCH).

56278 **(INIS-XN—125) International hydrocoin project. Groundwater hydrology modelling strategies for performance assessment of nuclear waste disposal. Level 1: code verification.** (Nuclear Energy Agency, 75 - Paris (France)). 1988. 198p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704357/JAW.

The international co-operation project HYDROCOIN for studying groundwater flow modelling in the context of radioactive waste disposal was initiated in 1984. Thirteen organizations from ten countries and two international organizations participate in the project which is managed by the Swedish Nuclear Power Inspectorate SKI. This report summarizes the results from the first phase of HYDROCOIN. Level 1, which has been devoted to verification of 29 computer programs for groundwater hydrology. This has been done by applying the codes to seven hypothetical test cases representing different physical situations. For linear test cases, the agreement between results calculated with different codes has been satisfactory for primarily calculated entities (groundwater pressure, salt concentration and temperatures). Results for properties derived from gradients of the primary field (groundwater velocity and trajectories) show agreement to a lesser extent. Furthermore, HYDROCOIN Level 1 illustrates problems related to solving strongly non-linear cases, such as coupled flow and brine transport. HYDROCOIN Level 1 has provided an efficient means for testing strengths and weaknesses of various strategies for groundwater flow modelling and post processing. As a result of the Level 1 effort, several code enhancements have been made.

56279 **(Juel—2198) Investigations with respect to pressure build-up in 200 l drums with supercompacted low level waste (LLW).** Kroth, K.; Lammertz, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemische Technologie der Nuklearen Entsorgung). Apr 1988. 35p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755180/JAW.

In the drum storage facilities of various nuclear power stations, ballooning effects have recently been observed on a limited number of 200 l drums filled with hypercompacted mixed LLW. The ballooning of the drums lid and bottom is due to internal overpressure caused by gas formation in the waste. The internal drum pressures and the composition of the drum gases were measured on a considerable number of 200 l drums. Hydrogen, formed by chemical reactions between the waste components, was identified as the pressure generating gas. The reasons for the hydrogen formation were investigated on both real and simulated wastes.

56280 **(Juel-Spez—430) Investigations on avoiding the formation of radiolysis hydrogen in 200 liter barrels with cemented medium activity waste (MAW) from WAK developing heat.** Lammertz, H.; Kroth, K. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemische Technologie der Nuklearen Entsorgung). Feb 1988. 46p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755183/JAW.

The investigations helped the search for a means which could be trickled for filling cemented MAW or an additive for cement, which, by releasing oxygen, reacts with radiolytically formed hydrogen to form water and make it harmless. A mixture of MnO/sub 2/ with Ag/sub 2/O and KMnO/sub 4/ proved to be suitable; the latter in a quantity of 1 kg can oxidise 215 litres of H/sub 2/ into H/sub 2/O. The production of concrete homogeneously dosed with KMnO/sub 4/ and Al/sub 2/O/sub 3/ with KMnO/sub 4/ fixed on the porous surface as reactive filler are described.

56281 **(K/ITP—173) An initial survey of nuclear material safeguards requirements applicable to the civilian waste management program.** Moran, B.W. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Sep 1988. Contract AC05-84OT21400. 16p. NTIS, PC A03/MF A01. Order Number DE89000670/JAW.

This report provides an initial survey of the domestic and international safeguards requirements and provides a general framework on which future studies may be based. Additional studies are needed to evaluate the activities required to implement effective safeguards within the civilian waste management system and to ensure compliance with all safeguards requirements. 16 refs.

56282 **(KFK—4300) Corrosion behavior of carbon steel containers with organic coating during interim storage and disposal of low-level radioactive wastes.** Hauser, W.; Fiehn, B.; Drobnik, S.; Wiume, D. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Entsorgungstechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Dekontaminationsbetriebe; Forschungs- und Materialpruefungsanstalt Baden-Wuerttemberg (FMPA), Stuttgart (Germany, F.R.)). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Entsorgungstechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Dekontaminationsbetriebe; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Entsorgungstechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Dekontaminationsbetriebe; Forschungs- und Materialpruefungsanstalt Baden-Wuerttemberg (FMPA), Stuttgart (Germany, F.R.)). Jun 1988. 64p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755184/JAW.

In the Federal Republic of Germany low and intermediate level wastes (e.g., solids, concentrates) are conditioned in carbon steel canisters with organic coating. For this purpose waste drums and steel sheet containers are used. They serve as unshielded packagings during interim storage, transport and disposal in the Konrad mine or in the Gorleben salt dome. Considering the licensing situation for the planned repositories, interim storage periods of up to 20 years are possible. During this period, the transport to the repository and in the operation phase of the repository, the integrity of the waste packaging must be guaranteed. Therefore, special attention must be paid to the corrosion behavior of the steel sheet packagings described in this report. For these reasons, corrosion studies were made on epoxy resin coated or polyurethane coated and uncoated stell sheet specimens. In the investigations design details of the containers (e.g., roundings, screwed connections, gaps, welded seams) as well as damage due to handling (cracks in the organic coating) were taken into account. The specimens were stored for six and twelve months, respectively, both in waste form simulates (inner corrosion of container) and under simulated conditions of an interim storage (storage hall) and of a repository (storage galeries in Konrad and Asse, salt brines) in order to be able to describe external container corrosion. Under simplifying boundary conditions an extrapolation is made of the test results. It has been possible to show that the carbon steel containers described here, provided with a 150 μm epoxy resin coating on the inner and external sides, fulfil the requirements imposed on them as regards their corrosion behavior.

56283 **(KY/L—1508) Summary of findings on evaluation of aqueous degreasers versus chlorinated solvents at the Paducah Gaseous Diffusion Plant.** Gunn, D. (Paducah Gaseous Diffusion Plant, KY (USA)). 1988. Contract AC05-84OU21400. 14p. (CONF-881054—1). NTIS, PC A03/MF A01. Order Number DE88017342/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

Spent trichloroethylene (TCE), 1,1,1-trichloroethane (TCane), and sludge are generated mainly as a result of vapor degreasing operations at the Paducah Gaseous Diffusion Plant (PGDP). Additionally, small quantities of spent chlorinated solvents are generated as a result of small parts cleanup. Additionally, some of the solvents become contaminated with uranium which classifies them as mixed waste for which no disposal method is currently available. Due to health and environmental concerns and the desire to minimize mixed and hazardous waste generation, a study was initiated to identify nonchlorinated, less toxic degreasers, perform laboratory testing of the most promising alternatives, and initiate field testing to determine if alternate degreasers present operational problems. The degreaser that cleaned and protected metal surfaces best was an all-purpose, water-based, hard surfacc cleaner consisting of biodegradable synthetic detergents, inorganic builders, and glycol either solvent. Additionally, this product was free-rinsing and did not leave any contaminants that would react with commonly used process gases. This product is recommended as a replacement for chlorinated solvents for many degreasing operations at PGDP.

56284 **(LBL—25657) Tracer transport in fractured rocks.** Tsang, C.F.; Tsang, Y.W.; Hale, F.V. (Lawrence Berkeley Lab., CA (USA)). Jul 1988. Contract AC03-76SF00098. 29p. (CONF-880583—5). NTIS, PC A03/MF A01. Order Number DE89001258/JAW.

From International conference on fluid flow in fractured rocks; Atlanta, GA, USA (15 May 1988).

Recent interest in the safety of toxic waste underground disposal and nuclear waste geologic repositories has motivated many studies of tracer transport in fractured media. Fractures occur in most geologic formations and introduce a high degree of heterogeneity. Within each fracture, the aperture is not constant in value but strongly varying. Thus for such media, tracer tends to flow through preferred flowpaths or channels within the fractures. Along each of these channels, the aperture is also strongly varying. A detailed analysis is carried out on a 2D single fracture with variable apertures and the flow through channels is demonstrated. The channels defined this way are not rigidly set pathways for tracer transport, but are the preferred flow paths in the sense of streamtubes in the potential theory. It is shown that such variable-aperture channels can be characterized by an aperture probability distribution function, and not by the exact deterministic geometric locations. We also demonstrate that the 2D tracer transport in a fracture can be calculated by a model of a system of 1D channels characterized by this distribution function only. Due to the channeling character of tracer transport in fractured rock, random point measurements of tracer breakthrough curves may give results with a wide spread in value due to statistical fluctuations. The present paper suggests that such a wide spread can probably be greatly reduced by making line/areal (or multiple) measurements covering a few spatial correlation lengths. 13 refs., 11 figs., 1 tab.

56285 **(LBL—25688) Modeling studies for multiphase fluid and heat flow processes in nuclear waste isolation.** Pruess, K. (Lawrence Berkeley Lab., CA (USA)). Jul 1988. Contract AC03-76SF00098. 12p. (CONF-881066—1). NTIS, PC A03/MF A01. Order Number DE88016635/JAW.

From 12. international symposium on the scientific basis for nuclear waste management; Berlin, F.R. Germany (10 Oct 1988).

Multiphase fluid and heat flow plays an important role in many problems relating to the disposal of nuclear wastes in geologic media. Examples include boiling and condensation processes near heat-generating wastes, flow of water and formation gas in partially saturated formations, evolution of a free gas phase from waste package corrosion in initially water-saturated environments, and redistribution (dissolution, transport, and precipitation) of rock minerals in non-isothermal flow fields. Such processes may strongly impact upon waste package and repository design considerations and performance. This paper summarizes important physical phenomena occurring in multiphase and nonisothermal flows, as well as techniques for their mathematical modeling and numerical simulation. Illustrative applications are given for a number of specific fluid and heat flow problems, including: thermohydrologic conditions near heat-generating waste packages in the unsaturated zone;

repository-wide convection effects in the unsaturated zone; effects of quartz dissolution and precipitation for disposal in the saturated zone; and gas pressurization and flow corrosion of low-level waste packages. 34 refs; 7 figs; 2 tabs.

56286 **(NAGRA-NTB—80-07) Explanations to Nagra's deep drilling program as preparing action with regard to the 'Project Guarantee'.** Thury, M. (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Sep 1980. 21p. (In German). Nagra, CH-5401 Baden, Switzerland.

In the present report The Nagra's deep drilling program as preparing action with regard to the 'Project Guarantee' is introduced. It has been worked out under consideration of the final repository concept for high-level radioactive wastes followed today and of the legislation requirements. In completion to the exploration applications for 12 trial boreholes, in which also the detailed measuring program is introduced, the fixation of the boreholes is presented in this report. 10 refs., 10 figs.

56287 **(NAGRA-NTB—80-08) Mathematical modelling of the leaching of solidified wastes.** Herrnberger, V. (2314000CH). (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Nov 1980. 63p. (In German). Nagra, CH-5401 Baden, Switzerland.

The existing mathematical models, which describe the time dependent leaching process of solidified waste products, are critically reviewed. Possible developments of the models are clarified. For the first time a general model is derived, which calculates the release rates of decay chain nuclides in solidified waste matrices. The model assumes nuclide-dependent, but time-independent leaching rates and a constant dissolution rate of the waste matrix. The balance equations for nuclide decay chains are generalized to take into account all leaching losses by a time-dependent transfer-function. The general solution of the balance equations include the special cases of pure dissolution and pure depletion of the waste matrix, which were published by other authors. The computer code LEACON was written, to calculate the release rates and under specified conditions the concentrations of the radionuclides. The decay chains are restricted to four members. The logic of the code is explained and the experience gained in its use is illustrated by means of a fully documented numerical example. The computer code LEACON is a practical and inexpensive tool for the calculations of release rates and concentrations of radionuclides within a flooded repository. (author) 12 refs., 2 figs., 14 tabs.

56288 **(NAGRA-NTB—87-11) Swiss program of investigations and surveillance of the radioactive waste disposal site in north-east Atlantic. Program 'PROSPER', final report.** Nyffeler, F. (Neuchatel Univ. (Switzerland). Inst. de Physique). (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Jun 1987. 41p. (In French). Nagra, CH-5401 Baden, Switzerland.

This report presents the final results from the activities of the PROSPER group during the first phase (1981-1986) of CRESP (Coordinated Research and Environmental Surveillance Programme) which was coordinated by the Nuclear Energy Agency of the OECD. The first two chapters outline the legal and historical framework of deep-sea dumping as a disposal option for radioactive wastes. The internationally coordinated research and surveillance programme at the disposal site in the NE Atlantic is described in chapter 3, while chapter 4 is dedicated to the Swiss contribution to the project, together with a resume of the most significant results obtained between 1982 and 1986. The research carried out by the PROSPER group relates to characterisation of the hydrological and nepheloid features at the disposal site, the geochemistry of the sediments and suspended materials and the bacterial activity in the sediments. New information has been obtained on the nepheloid zones which can be disturbed by deep ocean currents. The geochemical studies of the sediments have allowed the sedimentation and accumulation rates at the dumping site to be quantified. These results were integrated into the review of the suitability of the site carried out by the NEA/OECD in 1985. (author) 26 refs., 7 figs.

56289 **(NUREG/CR—4555-Rev.1) Generic cost estimates for the disposal of radioactive wastes.** Clark, R.; Knudson, R.; Sciacca, F.; Simion, G.; Nemergut, J.; Cohen, S.; Lobbin, F. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications; Science and Engineering Associates, Inc., Albuquerque, NM (USA)). Sep 1988. 168p. (SEA—87-288-04-A-1-Rev.1). NTIS, PC A08/MF A01 - GPO. Order Number TI89000224/JAW.

NRC regulatory impact analyses address the costs and benefits associated with proposed regulatory requirements. Many of these requirements will result in physical modifications to existing structures and systems at nuclear power plants. This report provides a methodology and data needed to estimate the generic costs of disposing of radioactive wastes that may be generated as a result of NRC regulations requiring modifications or repairs to nuclear facilities. Also presented are descriptions of typical low-level radioactive wastes generated at nuclear power plants and the various processes used to treat the wastes in preparation for shipment and burial. The waste disposal cost estimates included in this report cover all the major elements that contribute to the overall costs. The key factors that influence the costs are discussed. Pertinent ranges of values for the key variables are explored and important sensitivities identified. The cost implications of the burial surcharges authorized by the Low-Level Radioactive Waste Policy Amendments Act of 1985 are covered. Occupational radiation exposure associated with in-plant handling of the wastes is also discussed. This report updates and revises information presented in NUREG/CR-4555. 39 figs., 33 tabs.

56290 **(NUREG/CR—5094) Application of stochastic methods to the simulaton of large-scale unsaturated flow and transport.** Polmann, D.J.; Vomvoris, E.G.; McLaughlin, D.; Hammick, E.M.; Gelhar, L.W. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Civil Engineering). Sep 1988. 136p. NTIS, PC A07/MF A01 - GPO. Order Number TI89000474/JAW.

Numerical simulations are used to demonstrate features of large-scale flow and transport in heterogeneous unsaturated soils using effective expressions derived from a stochastic theory developed at MIT. The case of stratified soil is examined for one- and two-dimensional (2D) flow and 2D transport. Finite-difference methods are used in the flow analysis and a random-walk algorithm is used for transport. Input parameters are derived from statistics of soil samples collected at the site of a large-scale tracer experiment conducted by New Mexico State University (NMSU). This study examines spatial variability of saturated and unsaturated hydraulic conductivity regarding effects on the bulk character of moisture flow and solute transport (directional rates of movement and spreading of the plume). The numerical simulations demonstrate tension-dependent anisotropy, hysteresis and macrodispersion derived in the stochastic theory based on this spatial variability. These features cannot be explained using conventional deterministic models. Preliminary results suggest that the stochastic theory is better able to simulate the bulk character of the NMSU flow experiments compared to a deterministic model. Sensitivity analyses identify major factors of soil variability which control moisture flow and spreading. Results of this study indicate the need for careful experimental design and soils data collection. 88 refs., 42 figs., 4 tabs.

56291 **(ORNL—6416) Relative toxicity estimates and bioaccumulation factors for the Defense Priority Model.** Barnthouse, L.W.; Breck, J.E.; Jones, T.D.; Suter, G.W. II; Easterly, C.; Glass, L.R.; Owen, B.A.; Watson, A.P. (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 70p. NTIS, PC A04/MF A01. Order Number DE89001344/JAW.

The Department of Defense's Installation Restoration Program requires the identification and evaluation of sites where hazardous materials were disposed of in the past. Oak Ridge National Laboratory has developed a site-rating system, referred to as the Defense Priority Model (DPM), which is intended for use in determining priorities for remedial action at contaminated sites. In the DPM, the human health hazards and ecological hazards of contami-

nants identified through monitoring are assessed, using toxicological benchmarks and bioaccumulation factors that relate the concentrations measured to concentrations or doses that may be toxic to man or to nonhuman biota. A user's manual for the DPM has already been published. This report supports the user's manual by documenting (1) the methods and data sources used to develop the benchmarks and bioaccumulation factors and (2) the procedure for using these values to calculate health and ecological hazard scores. 95 refs., 4 figs., 13 tabs.

56292 **(ORNL—6423) 1DFEMWATER: A one-dimensional finite element model of WATER flow through saturated-unsaturated media.** Yeh, G.T. (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 168p. NTIS, PC A08/MF A01. Order Number DE89001345/JAW.

This report presents the development and verification of a one- dimensional finite element model of water flow through saturated- unsaturated media. 1DFEMWATER is very flexible and capable of modeling a wide range of real-world problems. The model is designed to (1) treat heterogeneous media consisting of many geologic formations; (2) consider distributed and point sources/sinks that are spatially and temporally variable; (3) accept prescribed initial conditions or obtain them from steady state simulations; (4) deal with transient heads distributed over the Dirichlet boundary; (5) handle time-dependent fluxes caused by pressure gradient on the Neumann boundary; (6) treat time-dependent total fluxes (i.e., the sum of gravitational fluxes and pressure-gradient fluxes) on the Cauchy boundary; (7) automatically determine variable boundary conditions of evaporation, infiltration, or seepage on the soil-air interface; (8) provide two options for treating the mass matrix (consistent and lumping); (9) provide three alternatives for approximating the time derivative term (Crank-Nicolson central difference, backward difference, and mid-difference); (10) give three options (exact relaxation, underrelaxation, and overrelaxation) for estimating the nonlinear matrix; (11) automatically reset the time step size when boundary conditions or source/sinks change abruptly; and (12) check mass balance over the entire region for every time step. The model is verified with analytical solutions and other numerical models for three examples.

56293 **(ORNL—6477) Accident analysis of railway transportation of low-level radioactive and hazardous chemical wastes: Application of the {open quotes}Maximum Credible Accident{close quotes} concept.** Ricci, E.; McLean, R.B. (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 26p. NTIS, PC A03/MF A01. Order Number DE89001389/JAW.

The maximum credible accident (MCA) approach to accident analysis places an upper bound on the potential adverse effects of a proposed action by using conservative but simplifying assumptions. It is often used when data are lacking to support a more realistic scenario or when MCA calculations result in acceptable consequences. The MCA approach can also be combined with realistic scenarios to assess potential adverse effects. This report presents a guide for the preparation of transportation accident analyses based on the use of the MCA concept. Rail transportation of contaminated wastes is used as an example. The example is the analysis of the environmental impact of the potential derailment of a train transporting a large shipment of wastes. The shipment is assumed to be contaminated with polychlorinated biphenyls and low-level radioactivities of uranium and technetium. The train is assumed to plunge into a river used as a source of drinking water. The conclusions from the example accident analysis are based on the calculation of the number of foreseeable premature cancer deaths the might result as a consequence of this accident. These calculations are presented, and the reference material forming the basis for all assumptions and calculations is also provided.

56294 **(ORNL/CSD/TM—246) Assessment of shielding analysis methods, codes, and data for spent fuel transport/storage applications.** Parks, C.V.; Broadhead, B.L.; Hermann, O.W.; Tang, J.S.; Cramer, S.N.; Gauthey, J.C.; Kirk, B.L.; Roussin, R.W. (Oak Ridge National Lab., TN (USA)). Jul 1988. Contract AC05-84OR21400. 178p. NTIS, PC A09/MF A01. Order Number DE89001308/JAW.

This report provides a preliminary assessment of the computational tools and existing methods used to obtain radiation dose rates from shielded spent nuclear fuel and high-level radioactive waste (HLW). Particular emphasis is placed on analysis tools and techniques applicable to facilities/equipment designed for the transport or storage of spent nuclear fuel or HLW. Applications to cask transport, storage, and facility handling are considered. The report reviews the analytic techniques for generating appropriate radiation sources, evaluating the radiation transport through the shield, and calculating the dose at a desired point or surface exterior to the shield. Discrete ordinates, Monte Carlo, and point kernel methods for evaluating radiation transport are reviewed, along with existing codes and data that utilize these methods. A literature survey was employed to select a cadre of codes and data libraries to be reviewed. The selection process was based on specific criteria presented in the report. Separate summaries were written for several codes (or family of codes) that provided information on the method of solution, limitations and advantages, availability, data access, ease of use, and known accuracy. For each data library, the summary covers the source of the data, applicability of these data, and known verification efforts. Finally, the report discusses the overall status of spent fuel shielding analysis techniques and attempts to illustrate areas where inaccuracy and/or uncertainty exist. The report notes the advantages and limitations of several analysis procedures and illustrates the importance of using adequate cross-section data sets. Additional work is recommended to enable final selection/validation of analysis tools that will best meet the US Department of Energy's requirements for use in developing a viable HLW management system. 188 refs., 16 figs., 27 tabs.

56295 **(ORNL/TM—10855) Transportation operations system cask maintenance facility: Systems requirements and description.** Attaway, C.R. (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 51p. (ORO/TOP—5401.0). NTIS, PC A04/MF A01. Order Number DE89001146/JAW.

The Department of Energy's Office of Civilian Radioactive Waste Management is developing a national repository for spent nuclear fuel and high-level radioactive waste to implement the requirements of the Nuclear Waste Policy Act. As part of this effort, the Transportation Operations Project Office of the Department of Energy in Oak Ridge, Tennessee, has the responsibility of accepting this waste from waste generators and transporting it to appropriate Federal Waste Management System facilities in specially constructed shipping casks. Maintenance will be required for these shipping casks and the associated supporting equipment. This document defines the requirements of a facility to provide that required cask system maintenance. This document does not define the requirements for vehicle maintenance which will be performed elsewhere.

56296 **(PNL—6544) Geochemical analysis of leachates from cement/low-level radioactive waste/soil systems.** Criscenti, L.J.; Serne, R.J. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 119p. NTIS, PC A06/MF A01. Order Number DE89001581/JAW.

Laboratory experiments were conducted as part of the Special Waste Form Lysimeters{endash}Arid Program. These experiments were conducted to investigate the performance of solidified low-level nuclear waste in a typical arid, near-surface disposal site, and to evaluate the ability of laboratory tests to predict leaching in actual field conditions. Batch leaching, soil adsorption column, and soil/waste form column experiments were conducted using Portland III cement waste forms containing boiling-water reactor evaporator concentrate and ion-exchange resin waste. In order to understand the reaction chemistry of the cement waste form/soil/groundwater system, the compositions of the leachates from the laboratory experiments were studied with the aid of the MINTEQ ion speciation/solubility and mass transfer computer code. The purpose of this report is to describe the changes in leachate composition that occur during the course of the experiments, to discuss the geochemical modeling results, and to explore the factors controlling the major element chemistry of these leachates. 18 refs., 84 figs., 14 tabs.

56297 **(PNL—6671) Revised ground-water monitoring compliance plan for the 300 area process trenches.** Schalla, R.; Aaberg, R.L.; Bates, D.J.; Carlile, J.V.M.; Freshley, M.D.; Liikala, T.L.; Mitchell, P.J.; Olsen, K.B.; Rieger, J.T. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 431p. NTIS, PC A19/MF A01. Order Number DE89001462/JAW.

This document contains ground-water monitoring plans for process-water disposal trenches located on the Hanford Site. These trenches, designated the 300 Area Process Trenches, have been used since 1973 for disposal of water that contains small quantities of both chemicals and radionuclides. The ground-water monitoring plans contained herein represent revision and expansion of an effort initiated in June 1985. At that time, a facility-specific monitoring program was implemented at the 300 Area Process Trenches as part of a regulatory compliance effort for hazardous chemicals being conducted on the Hanford Site. This monitoring program was based on the ground-water monitoring requirements for interim-status facilities, which are those facilities that do not yet have final permits, but are authorized to continue interim operations while engaged in the permitting process. The applicable monitoring requirements are described in the Resource Conservation and Recovery Act (RCRA), 40 CFR 265.90 of the federal regulations, and in WAC 173-303-400 of Washington State's regulations (Washington State Department of Ecology 1986). The program implemented for the process trenches was designed to be an alternate program, which is required instead of the standard detection program when a facility is known or suspected to have contaminated the ground water in the uppermost aquifer. The plans for the program, contained in a document prepared by the US Department of Energy (USDOE) in 1985, called for monthly sampling of 14 of the 37 existing monitoring wells at the 300 Area plus the installation and sampling of 2 new wells. 27 refs., 25 figs., 15 tabs.

56298 **(PNL—6686) Nuclear waste treatment program: Annual report for FY 1987.** Brouns, R.A.; Powell, J.A. (comps.). (Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 186p. NTIS, PC A09/MF A01. Order Number DE89001847/JAW.

Two of the US Department of Energy's (DOE) nuclear waste management-related goals are to ensure that waste management is not an obstacle to the further development of light-water reactors and the closure of the nuclear fuel cycle and to fulfill its institutional responsibility for providing safe storage and disposal of existing and future nuclear wastes. As part of its approach to achieving these goals, the Office of Remedial Action and Waste Technology of DOE established what is now called the Nuclear Waste Treatment Program (NWTP) at the Pacific Northwest Laboratory during the second half of FY 1982. To support DOE's attainment of its goals, the NWTP is to provide technology necessary for the design and operation of nuclear waste treatment facilities by commercial enterprises as part of a licensed waste management system and problem-specific treatment approaches, waste form and treatment process adaptations, equipment designs, and trouble-shooting assistance, as required to treat existing wastes. This annual report describes progress during FY 1987 towards meeting these two objectives. 24 refs., 59 figs., 24 tabs.

56299 **(PNL-SA—15367) Hydra-II, a computer code for hydrothermal analysis of spent fuel storage systems.** McCann, R.A. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1988. Contract AC06-76RL01830. 7p. (CONF-880724—25). NTIS, PC A02. Order Number DE89000399/JAW.

From 25. American Society of Mechanical Engineers/American Institute of Chemical Engineers/American Nuclear Society national heat transfer conference; Houston, TX, USA (24 Jul 1988).

HYDRA-II is a hydrothermal computer code designed to accurately predict steady-state fluid flow and temperature distributions in spent nuclear fuel storage and transportation systems. The code is capable of three-dimensional analysis of coupled conduction, convection, and thermal radiation problems. It provides a finite difference solution in cartesian coordinates to the equations governing the conservation of mass, momentum, and energy. A cylindrical coordinate system may also be used to enclose the cartesian coordinate system. This exterior coordinate system is useful for modeling cylindrical cask bodies. The basic equations and an overview of the numerics employed in their solution are presented. Selected results from an extensive code verification/validation effort are also presented. Comparisons are made between the results of simulations of a multiassembly storage system and actual experimental data. The effects of backfill gas composition and pressure and cask orientation are illustrated.

56300 **(PNL-SA—16084) An interim evaluation of the thermal stability of Cu/sub 0.67/Y/sub 0.25/Kr/sub 0.08/ sputter deposits.** McClanahan, E.D.; Bradley, E.R. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1988. Contract AC06-76RL01830. 17p. (CONF-880815—1). NTIS, PC A03/MF A01. Order Number DE89000400/JAW.

From 20. DOE/NRC nuclear air cleaning conference; Boston, MA, USA (22 Aug 1988).

Pacific Northwest Laboratory (PNL) has developed and demonstrated a pilot process for trapping and storing ^{85}Kr recovered and purified from the dissolver off-gas stream of a nuclear fuel reprocessing plant. Ions produced in a low-pressure krypton discharge are implanted in a growing sputtered film of Cu/sub 0.67/Y/sub 0.25/Kr/sub 0.08/ deposited on the inner wall of a krypton trapping storage device (KTSD). A main objective of this work is to measure the release of ^{85}Kr implanted in a copper-yttrium alloy. The overall release characteristics of the deposits are quite favorable for long-term storage. Both the radioactive and nonradioactive test specimens stored at temperatures not exceeding 350{degree}C have shown that the release rates measured to date are $<0.1\%$ yr^{-1}. The release rates for the radioactive specimens were obtained for storage periods of 1.6, 1.1 and 0.4 yr for 150, 250 and 350{degree}C storage temperatures, respectively. The nonradioactive specimen has been held at temperatures ranging between 180 and 450{degree}C, but mainly at 350{degree}C, for a total storage time of 2.1 yr. Following the {approximately}10-yr monitoring period, the remaining Cu-Y-^{85}Kr waste form should be evaluated to better predict overall stability for the full storage period (50 to 100 yr). 5 refs., 6 figs., 2 tabs.

56301 **(PNL-SA—16134) Intruder scenarios for site-specific waste classification.** Kennedy, W.E. Jr. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1988. Contract AC06-76RL01830. 11p. (CONF-880839—4). NTIS, PC A03/MF A01. Order Number DE88015928/JAW.

From Annual DOE low-level waste management conference; Denver, CO, USA (30 Aug 1988).

The US Department of Energy (DOE) is currently revising its low-level radioactive waste (LLW) management requirements and guidelines for waste generated at its facilities that support defense missions. The draft DOE policy calls for DOE LLW operations to be managed to protect the health and safety of the public, preserve the environment, and ensure that no remedial action will be necessary after termination of operations. The requirements and guidelines apply to radioactive wastes but are also intended to apply to mixed hazardous and radioactive wastes. The basic approach used by DOE is to establish overall performance objectives in terms of ground-water protection and public radiation dose limits and to require site-specific performance assessments to determine compliance. As a result of these performance assessments to determine compliance. As a result of these performance assessments, each site shall develop waste acceptance criteria that define the allowable quantities and concentrations of specific radioisotopes. Additional limitations on waste disposal design, waste form, and waste treatment shall also be developed on a site-specific basis. As a key step in the site-specific performance assessments, an evaluation must be conducted of potential radiation doses to intruders who may inadvertently move onto a closed DOE LLW disposal site after loss of institutional controls must be conducted. This paper describes the types of intruder scenarios that should be considered when performing this step of the site-specific performance assessment. 9 refs., 1 tab.

56302 **(PNL/SRP—6221) Corrosion behavior on A216 Grade WCA mild steel and Ti Grade 12 alloy in hydrothermal brines: Salt Repository Project: Annual report, FY 1986.** Westerman, R.E.; Haberman, J.H.; Pitman, S.G.; Pool, K.H.; Rhoads, K.C.; Telander, M.R. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1988. Contract AC06-76RL01830. 240p. NTIS, PC A11/MF A01. Order Number DE89000284/JAW.

The present document describes work performed at PNL during FY 1985 and FY 1986 that was directed toward characterizing the corrosion behavior of the candidate barrier materials in salt-repository- relevant, hydrothermal brine environments. The significant degradation modes of the materials were evaluated and prioritized, and the corresponding corrosion and environmental-mechanical work was performed. The objective of the work was to augment the material performance data base that will ultimately be used in the development of the predictive degradation models required for waste package licensing. The specific experimental objectives of the work performed through FY 1986 have been to quantify, to the degree possible, the rates of general corrosion of A216 steel; the susceptibility of this material to pitting, crevice corrosion, and stress-corrosion cracking; and the susceptibility of Ti Grade 12 to crevice corrosion and hydrogen absorption. These are the degradation modes judged potentially most deleterious (with the possible exception, for Ti Grade 12, of hydrogen-induced delayed failure) to the application of the two candidate barrier materials in a salt repository environment. 64 refs., 69 figs., 25 tabs.

56303 **(PNL/SRP—6638) Statistical methods for mechanistic model validation: Salt Repository Project.** Eggett, D.L. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1988. Contract AC06-76RL01830. 23p. NTIS, PC A03/MF A01. Order Number DE89001011/JAW.

As part of the Department of Energy's Salt Repository Program, Pacific Northwest Laboratory (PNL) is studying the emplacement of nuclear waste containers in a salt repository. One objective of the SRP program is to develop an overall waste package component model which adequately describes such phenomena as container corrosion, waste form leaching, spent fuel degradation, etc., which are possible in the salt repository environment. The form of this model will be proposed, based on scientific principles and relevant salt repository conditions with supporting data. The model will be used to predict the future characteristics of the near field environment. This involves several different submodels such as the amount of time it takes a brine solution to contact a canister in the repository, how long it takes a canister to corrode and expose its contents to the brine, the leach rate of the contents of the canister, etc. These submodels are often tested in a laboratory and should be statistically validated (in this context, validate means to demonstrate that the model adequately describes the data) before they can be incorporated into the waste package component model. This report describes statistical methods for validating these models. 13 refs., 1 fig., 3 tabs.

56304 **(PNL/SRP—6641) Corrosion of carbon and low-alloy steel weldments in brines: A literature review: Salt Repository Project.** Reimus, P.W. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1988. Contract AC06-76RL01830. 109p. NTIS, PC A04/MF A01. Order Number DE89000283/JAW.

The literature indicates that corrosion of carbon and low-alloy steel weldments in brines should not be a major concern if the weld is properly designed and fabricated. Seven characteristics of a weld can affect the corrosion performance of the weldment including composition of the weld metal (with respect to that of the parent metal); microstructure of the weld metal, heat-affected zone (HAZ), and parent metal; size and number of defects (cracks and pores) in the weld metal and HAZ (both internal and external); size, shape composition, location, and number of nonmetallic inclusions in the weld metal and HAZ; residual stress distribution in the weld; hydrogen content of the weld; and geometry of the weld at the outer surface. The effects of these characteristics on weldment corrosion are discussed in the report. 104 refs., 14 figs.

56305 **(PNL/SRP—6642) Understanding the kinetics of sulfate reduction in brines by hydrogen: Progress report.** Strachan, D.M. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1988. Contract AC06-76RL01830. 19p. NTIS, PC A03/MF A01. Order Number DE89000265/JAW.

Experiments were conducted with mixtures of hydrogen gas and each of PBB1 and PBB3 brines to examine the reduction kinetics of sulfate in high ionic strength solutions. Results from the experiments with brines showed that the kinetics of sulfate reduction is slower in high ionic strength solutions than the kinetics in low ionic strength solutions. However, the kinetic mechanism does not seem to alter the slow kinetics, but the addition of much larger quantities of sulfide, about 40 mM, does accelerate the reduction of sulfate. Since the proposed reaction mechanism for the reduction of sulfate by hydrogen gas involves the reaction of sulfide with sulfate, slow initial kinetics in the absence of sulfide is understandable, but also implies an unknown rate-limiting reaction. Precipitation of calcium sulfate(s) and calcium sulfide may limit the sulfide and sulfate concentrations to low values. The coexistence of anhydrite and oldhamite may indicate a part of the Ca-S-H_2O that has not yet been investigated. 6 refs., 4 figs., 3 tabs.

56306 **(PNL/SRP—6643) Degradation modes of nickel-base alternate waste package overpack materials.** Pitman, S.G. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1988. Contract AC06-76RL01830. 53p. NTIS, PC A04/MF A01. Order Number DE89000683/JAW.

The suitability of Ti Grade 12 for waste package overpacks has been questioned because of its observed susceptibility to crevice corrosion and hydrogen-assisted crack growth. For this reason, materials have been selected for evaluation as alternatives to Ti Grade 12 for use as waste package overpacks. These alternative materials, which are based on the nickel-chromium-molybdenum (Ni-Cr-Mo) alloy system, are Inconel 625, Hastelloy C-276, and Hastelloy C-22. The degradation modes of the Ni-base alternate materials have been examined at Pacific Northwest Laboratory to determine the suitability of these materials for waste package overpack applications in a salt repository. Degradation modes investigated included general corrosion, crevice corrosion, pitting, stress-corrosion cracking, and hydrogen embrittlement.

56307 **(PNL/SRP—6661) Modeling of nonuniform corrosion in salt brines: Salt Repository Project.** Reimus, P.W. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1988. Contract AC06-76RL01830. 43p. NTIS, PC A03/MF A01. Order Number DE89000269/JAW.

A mechanistic approach to modeling nonuniform corrosion in brines is presented in this report. Equations are derived for completely describing the electrochemical environment within a localized corrosion cavity, and appropriate initial and boundary conditions are invoked to obtain a solvable system of equations. The initial and boundary conditions can be adjusted to simulate pitting, crevice corrosion, or stress corrosion cracking. Although no numerical results are presented, a numerical strategy for solving the equations is presented. The report focuses on the nonuniform corrosion behavior of mild steel; however, the modeling approach presented is expected to apply to a broad range of metallic materials. 34 refs., 5 figs., 2 tabs.

56308 **(PNL/SRP—6662) Localized corrosion of mild steel nuclear waste package containers: Salt Repository Project.** Reimus, P.W. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1987. Contract AC06-76RL01830. 124p. NTIS, PC A06/MF A01. Order Number DE89000281/JAW.

The purpose of this report is to describe the characteristics of five modes of localized corrosion that were identified as being potentially detrimental to the integrity of mild steel nuclear waste packages in a geologic repository. These include pitting, crevice corrosion, stress corrosion cracking, galvanic/thermogalvanic corrosion, and hydrogen-related failures. Recommendations for investigation and control of these phenomena are also provided. 104 refs., 17 figs., 2 tabs.

56309 **(PNL/SRP—6663) Assessment of the significance of gamma radiolysis on uniform corrosion of container materials: Salt Repository Project.** Gray, W.J.; Doherty, A.L. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1988. Contract AC06-76RL01830. 21p. NTIS, PC A03/MF A01. Order Number DE89000270/JAW.

The maximum possible enhancement of uniform corrosion of container material (e.g., mild steel) by gamma radiation in a high-level radioactive waste repository during the first 1000 years after emplacement has been calculated as a function of container wall thickness. Calculations were performed for Commercial High Level Waste (CHLW) and Spent Fuel from a Pressurized Water Reactor (SFPWR) over a range of container wall thickness from 0 to 15 cm. The calculations were performed specifically for a salt repository, but the nature of the calculations was such that the results apply equally well to a repository in any type of geology. The calculations conceptually were divided into three steps: 1) calculation of the total amount of gamma energy that penetrates the container/host rock interface as a function of container wall thickness and time; 2) determination of the amount of oxidizing species formed in the surroundings per unit of absorbed gamma energy; and 3) evaluation of the types of corrosion reactions that are likely to occur. Calculations involved in the latter two steps were based on assumptions that are so clearly conservative that the derived uniform corrosion values can unequivocally be stated to be the maximum possible. On that basis, uniform corrosion depths exceeding 1% of the container wall thickness were calculated to occur in 1000 years only for original wall thicknesses less than about 9.5 cm for CHLW or 7.5 cm for SFPWR. 14 refs., 2 figs.

56310 **(PNL/SRP—6665) Final status of the salt repository project waste package program experimental database.** Thornton, B.M.; Reimus, P.W. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1988. Contract AC06-76RL01830. 53p. NTIS, PC A04/MF A01. Order Number DE89000260/JAW.

This report describes the final status of the Salt Repository Project Waste Package Program Experimental Database. The data base serves as a clearinghouse for all data collected within the Waste Package Program (WPP) and its predecessor programs at Pacific Northwest Laboratory (PNL). The database was maintained using RS/1 database management software. Documented assurance that the entries in the database were consistent with experimental records was provided by having each experimentalist inspect the entries and signify that they were in agreement with the records. The inspection and signoff were done per PNL technical procedures. Data for which it was impossible to obtain the experimentalist's inspection and signature were segregated from the rest of the database, although they could still be accessed by WPP staff. The WPPED contains two groups of subdirectories. One group contains data taken prior to the installation of quality assurance procedures at PNL. The other group of subdirectories contains data taken under the NQA-1 procedures since their installation in April 1985. As part of closeout activities in the Salt Repository Project, the WPP database has been archived onto magnetic media. The data in the database are available by request on magnetic media or in hardcopy form. 2 refs.

56311 **(PNL/SRP—6666) Development of a mechanistic model for release of radionuclides from spent fuel in brines: Salt Repository Project.** Reimus, P.W.; Windisch, C.F. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1988. Contract AC06-76RL01830. 57p. NTIS, PC A04/MF A01. Order Number DE89000267/JAW.

At present there are no comprehensive mechanistic models describing the release of radionuclides from spent fuel in brine environments. This report provides a comprehensive review of the various factors that can affect radionuclide release from spent fuel, suggests a modeling approach, and discusses proposed experiments for obtaining a better mechanistic understanding of the radionuclide release processes. Factors affecting radionuclide release include the amount, location, and disposition of radionuclides in the fuel and environmental factors such as redox potential, pH, the presence of complexing anions, temperature, and radiolysis. It is concluded that a model describing the release of radionuclides from spent fuel should contain separate terms for release from the gap, grain boundaries, and grains of the fuel. Possible functional forms for these terms are discussed in the report. Experiments for assessing their validity and obtaining key model parameters are proposed. 71 refs., 4 figs., 6 tabs.

56312 **(PNL/SRP—6676) A general model for the dissolution of nuclear waste glasses in salt brine.** McGrail, B.P.; Strachan, D.M. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1988. Contract AC06-76RL01830. 57p. NTIS, PC A04/MF A01. Order Number DE89000266/JAW.

A mechanistic model describing a dynamic mass balance between the production and consumption of dissolved silica was found to describe the dissolution of SRL-165 defense waste glass in a high-magnesium (PBB3) brine at a temperature of 90{degree}C. The synergetic effect of the waste package container on the glass dissolution rate was found to depend on a precipitation reaction for a ferrous silicate mineral. The model predicted that the ferrous silicate precipitate should be variable in composition where the iron-silica ratio depended on the metal-to-glass surface area ratio used in the experiment. This prediction was confirmed experimentally by the variable iron-silica ratios observed in filtered leachates. However, the interaction between dissolved silica and iron corrosion products needs to be much better understood before the model could be used with confidence in predicting radionuclide release rates for a salt repository. If the deleterious effects of the iron corrosion products can be shown to be transient, and the fracturing of the glass can be minimized, it appears that the performance of SRL-165 defense waste glass will be near the NRC regulatory criterion for fraction release of one part in 100,000 in PBB3 brine at 90{degree}C under silica-saturated conditions. 47 refs., 6 figs., 1 tab.

56313 **(PNL/SRP—6689) Effect of surface oxidation, alpha radiolysis, and salt brine composition on spent fuel and UO_2 leaching performance: Salt Repository Project.** Gray, W.J. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1988. Contract AC06-76RL01830. 117p. NTIS, PC A06/MF A01. Order Number DE89000403/JAW.

This report describes the results of three different series of leach tests on spent fuel and unirradiated UO_2 designed to aid in the safety evaluation. Also described are the results of associated tests that involved (1) the surface characterization of spent fuel specimens and (2) the determination of alpha and beta/gamma dose rates associated with spent fuel leach tests. One leach test series was designed to compare the leach performance of spent fuel in different brine compositions; one brine consisted primarily of NaCl, and the other contained large amounts of $MgCl_2$ as well as NaCl and other salts. The other two leach test series were designed to investigate a difference between spent fuel and unirradiated UO_2 that was reported previously (Barner et al. 1986). In one of the latter series, leach tests were performed on UO_2 that had been doped with Pu to simulate the alpha activity of spent fuel specimens. In the final series, leach tests were conducted on spent fuel specimens that originated in the same reactor assembly as those used in previous tests but were handled differently following discharge from the reactor. The spent fuel leach tests in different brines led to similar results except for higher Pu concentrations in the high-Mg brine. Alpha radiolysis was found to have little effect on the mass loss of U from UO_2 in the air-saturated brines used in these tests. Most of the difference between spent fuel and UO_2 observed in previous tests appears to be attributable to alteration of the surfaces of the spent fuel specimens during storage after they were discharged from the reactor. 18 refs., 21 figs., 8 tabs.

56314 **(PNL/SRP—6694) Data report on static leach tests with Savannah River Laboratory Defense Waste Glass in PBB3 brine at 90{degree}C: Salt Repository Project.** McGrail, B.P.; Eliason, V.L. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1988. Contract AC06-76RL01830. 19p. NTIS, PC A03/MF A01. Order Number DE89000282/JAW.

Static leach tests were performed with Savannah River Laboratory Defense Waste Glass (SRL-165) in Permian Basin Brine No. 3 as part of the Defense Glass Studies Program. Data from the tests are reported here to assist the Salt Repository Project in

showing compliance with the Nuclear Regulatory Commission slow-release limit criterion. The objective of the tests was to evaluate radionuclide saturation concentrations, colloid formation, and glass dissolution kinetics of SRL-165 under the prescribed conditions. The test matrix contained variations in the ratios of glass surface area to brine volume, metal to glass surface area, and mass of salt to mass of glass. The measured variables included brine pH and solution concentrations for both stable and radioactive elements. The data will be used to develop a model for radionuclide release from defense waste glass. 1 tab.

56315 **(SAND—84-1697) Capillary-driven flow in a fracture located in a porous medium.** Martinez, M.J. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1988. Contract AC04-76DP00789. 52p. NTIS, PC A04/MF A01. Order Number DE89001055/JAW.

Capillary-driven immiscible displacement of air by water along an isolated fracture located in a permeable medium is induced by an abrupt change in water saturation at the fracture inlet. The fracture is idealized as either a smooth slot with permeable walls or a high-permeability later. The penetration distance of moisture in the fracture permeability ratio and length scales for the problem. The models are applied to materials representative of the Yucca Mountain region of the Nevada Test Site. Fracture moisture-penetration histories are predicted for several units in Yucca Mountain and for representative fracture apertures. 18 refs., 20 figs., 6 tabs.

56316 **(SAND—87-1375) An interim report on excavation effect studies at the Waste Isolation Pilot Plant: The delineation of the disturbed rock zone.** Borns, D.J.; Stormont, J.C. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1988. Contract AC04-76DP00789. 30p. NTIS, PC A03/MF A01. Order Number DE89000626/JAW.

For nuclear waste repositories with both long operational periods (50 yr) and long performance assessment periods (10,000 yr), the Disturbed Rock Zone (the zone of rock in which the mechanical and hydrologic properties have changed in response to excavation; abbreviated as DRZ) is important to both operational (e.g., slab or fracture failure of the excavation) and long term performance (e.g., seal system performance and fluid transport). At the Waste Isolation Pilot Plant (WIPP), the DRZ has been characterized with three approaches: visual observation; geophysical methods; and permeability measurements. Visual observations in drillholes indicate that fluids and fractures are common in the host rock of the underground facility. Geophysical studies have utilized radar, electromagnetic (EM), and direct current (DC) electromagnetic methods. Radar has been useful, but the penetration is limited by the water content and bedded nature of the host rock. The EM method was able to detect a fourfold increase in resistivity from 1 to 5 m into the rock. This trend reflects a fourfold increase in the moisture content from near the excavation (0.5 to 1% by weight) to 5 m into the host rock (2 to 3% by weight). The DC method has been able to detect zones of moisture around the excavation. Numerous gas permeability measurements indicate that beyond 2 m from an excavation halite and interbeds (anhydrite and clay) allow very low gas flow (calculated permeabilities <1 microdarcy for gas flow tests and <0.01 microdarcy for brine based permeability tests). Within 2 m of the excavation, very high flow rates (10^4 SCCM) were measured. All three approaches have defined a DRZ at the WIPP extending laterally throughout the excavation and varying in depth from 1 to 5 m, according to the size and age of the opening. 29 refs., 11 figs., 1 tab.

56317 **(SAND—87-2438) Feasibility of disposal of high-level radioactive wastes into the seabed: Review of laboratory investigations of radionuclide migration through deep-sea sediments.** Brush, L.H. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1988. Contract AC04-76DP00789. 254p. NTIS, PC A12/MF A01. Order Number DE89001051/JAW.

The Sediment Barrier Task Group (SBTG) coordinated laboratory studies of radionuclide migration through deep-sea sediments by investigators in six countries over a period of 12 years. The objectives of these studies were to evaluate the barrier properties of a variety of deep- sea sediments from study locations characterized by the Site Assessment Task Group (SATG), and to obtain site-specific data for use by the Radiological Assessment Task Group (RATG) in models of radionuclide transport through the sediments at the Great Meteor East (GME) and Southern Nares Abyssal Plain (SNAP) study locations in the North Atlantic Ocean. This volume presents a review of these laboratory investigations and the results obtained from them. Although the SBTG also participated in numerous geochemical investigations at the study locations characterized by the SATG, these field studies are not discussed here. For the convenience of the reader, however, this volume contains a brief description of the sediments from GME and SNAP, and the Mid-Plate Mid-Gyre I (MPG I) study location in the North Pacific Ocean. 130 refs., 48 figs., 11 tabs.

56318 **(SAND—87-2670) Remote cask handling and implications for cask system design.** Griesmeyer, J.M.; Thunborg, S. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1988. Contract AC04-76DP00789. 58p. NTIS, PC A04/MF A01. Order Number DE88017300/JAW.

Robotic handling of nuclear waste shipping casks has the potential to significantly reduce occupational radiation exposure and computer monitoring of operator interactions with the system can improve safety. Furthermore, robot programmability can provide an automated audit trail for quality assurance. This report discussed the impact of cask design on the potential application of robotic systems to repository based nuclear waste shipping cask handling operations. The main conclusions are: (1) incorporation of cask system design features which facilitate robotic cask handling can be achieved with minimal impact on cask functional features, (2) proper cask design allows robotic cask handling operations from unbolting cask tie-down straps to radiation surveys to be performed quickly and reliably without direct human intervention, and (3) design for remote handling also facilitates manual handling operations. 12 refs., 9 figs., 4 tabs.

56319 **(SAND—87-7070) Hydrologic modeling of vertical and lateral movement of partially saturated fluid flow near a fault zone at Yucca mountain.** Wang, J.S.Y.; Narasimhan, T.N. (Sandia National Labs., Albuquerque, NM (USA); Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC04-76DP00789. 76p. NTIS, PC A05. Order Number DE89000667/JAW.

Distribution of fluid flow is governed by the balance between gravity and capillary forces. The objective of this work is to assess fluid flow in the partially saturated, fractured, porous tuff formations at Yucca Mountain. The effects of eastern tilting of the units at Yucca Mountain on fluid flow has been studied using two-dimensional models. Ghost Dance Fault has been modeled as a seepage face. Under the expected flux conditions, saturation increased just to the west of the fault, but the water did not enter the fault. Tuff matrix and fracture data have been compared to the limited model parameters of the fault; and correlations between saturated conductivity and unsaturated parameters for tuff matrix, fracture, and fault are discussed. 26 refs., 33 figs., 5 tabs.

56320 **(SAND—88-0112) Brine inflow to WIPP disposal rooms: Data, modeling, and assessment.** Nowak, E.J.; McTigue, D.F.; Beraun, R. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1988. Contract AC04-76DP00789. 79p. NTIS, PC A05/MF A01. Order Number DE89000628/JAW.

A WIPP data base that characterizes brine movement and accumulation is summarized and analyzed. The data are interrupted in terms of a model for flow in a saturated porous medium. The model, summarized in this report, embodies the Darcy-flow assumption and storage due to linearly elastic compression of the salt and brine. Comparisons between model calculations and brine inflow rates measured in the WIPP show order-of-magnitude agreement for permeabilities in the range of 10{sup{minus}21} to 10{sup{minus}20} m^2 (1-10 nanodarcies) 2}. These values of permeability are in accord with independent, in situ determinations of permeability in the salt. Expected accumulations of brine in typical WIPP waste disposal rooms were calculated by numerical methods using a mathematical description for the brine inflow model. The expected brine accumulation in a disposal room was calculated to be in the range of 4 m{sup 3} to 43 m{sup 3} in 100 years. WIPP

disposal rooms, filled with waste and backfilled, are expected to be virtually completely reconsolidated due to host rock creep in about 100 years, preventing further accumulation of brine. Calculations show that water-absorbing tailored backfill materials can readily absorb the maximum expected brine accumulations in WIPP disposal rooms while maintaining adequate mechanical strength. 59 refs., 20 figs., 4 tabs.

56321 **(SAND—88-0380) Standard thermal problem set for the evaluation of heat transfer codes used in the assessment of transportation packages.** Glass, R.E.; Burgess, M.; Livesey, E.; Geffroy, J.; Bourdon, S.; Mennerdahl, D.; Cherubini, A.; Giambuzzi, S.; Nagel, P. (Sandia National Labs., Albuquerque, NM (USA); UKAEA Atomic Energy Establishment, Winfrith; British Nuclear Fuels Ltd., London; CEA, 75 - Paris (France); E. M. Systems (Sweden); ENEA, Rome (Italy); Nuclear Energy Agency, 75 - Paris (France)). Aug 1988. Contract AC04-76DP00789. 44p. (TTC—0783). NTIS, PC A03/MF A01. Order Number DE89001035/JAW.

The design and certification of packages used for the shipment of nuclear materials requires that well established analytical techniques are available to predict the behavior of the packagings during normal transport and hypothetical accident environments. The Organization of Economic Cooperation and Development (OECD), through the Nuclear Energy Agency's Committee on Reactor Physics (NEACRP), has established specialists' meetings in the areas of heat transfer, criticality, and shielding. The subject of this paper is the work resulting from the Specialists' Meetings on the Heat Transfer Assessment of Transportation Packages. The heat transfer group held its first meeting in April 1985 with the purpose of defining a set of thermal benchmark problems and providing solutions. A set of six two-dimensional thermal problems has been defined and analytical solutions provided. These problems, and the corresponding solutions, are provided in this report. In addition, magnetic tapes, including computer code input and output, are being provided to the NEA Data Bank. The codes used to provide numerical analysis range from the cask specific codes such as RIGG to general purpose codes such as Q/TRAN. These codes were all used in the two-dimensional mode although many were capable of solving three-dimensional problems. 15 figs., 17 tabs.

56322 **(SAND—88-1135C) Retrieval and analysis of simulated defense HLW [high-level waste] package experiments at the WIPP [Waste Isolation Pilot Plant].** Molecke, M.A.; Sorensen, N.R. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 9p. (CONF-881066—2). NTIS, PC A02/MF A01. Order Number DE89000440/JAW.

From 12. international symposium on the scientific basis for nuclear waste management; Berlin, F.R. Germany (10 Oct 1988).

In situ waste package performance experiments involving simulated (non-radioactive) defense high-level waste (DHLW) containers have been in progress since late 1984 at the Waste Isolation Pilot Plant (WIPP) facility. These experiments involve full-size, simulated DHLW containers of several metals and designs emplaced in the WIPP bedded rock salt. These test containers are surrounded by granular backfill (packing) materials, have in many cases been intentionally injected with brines, and are heavily instrumented. A majority of the test packages also contain nonradioactive DHLW borosilicate glass waste form, either within the container and/or outside of it. The primary purpose of these WIPP simulated DHLW experiments is to evaluate the in situ durability and performance of all waste package engineered barrier materials, and to perform package concept validation testing. Twelve of the test DHLW containers, emplaced in WIPP test Room B, have been in heated operation since 1985 and had a maximum surface temperature of about 190{degree}C. These containers were recently retrieved, after about 3 years of heated exposure, for detailed posttest laboratory analyses of: general corrosion and metallurgical degradation, waste form and backfill materials alterations, and other rock salt-brine-barrier materials near-field interactions with the "repository" geochemical environment. Test canisters and overpacks made of ASTM Grade-12 titanium showed essentially no visible degradation in either the base metal or welds; cast mild steel A216/WCA overpacks have suffered some uniform corrosion. 11 refs.

56323 **(SAND—88-1227C) Decision-making methodology for management of hazardous waste.** Philbin, J.S.; Cranwell, R.M. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 9p. (CONF-881054—9). NTIS, PC A02/MF A01. Order Number DE89001228/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

A decision-making methodology is presented that combines systems and risk analysis techniques to evaluate hazardous waste management practices associated with DOE weapon production operations. The methodology provides a systematic approach to examining waste generation and waste handling practices in addition to the more visible disposal practices. Release-exposure scenarios for hazardous waste operations are identified and operations risk is determined. Comparisons may be made between existing and alternative waste management practices (and processes) on the basis of overall risk, cost and compliance with regulations. Managers can use this methodology to make and defend resource allocation decisions and to prioritize research needs. 13 refs., 2 figs.

56324 **(SAND—88-1916C) Long-term materials testing of transportable storage cask containment and basket materials.** Ottinger, C.A.; Mings, W.J. (Sandia National Labs., Albuquerque, NM (USA); Idaho National Engineering Lab., Idaho Falls (USA)). 1988. Contract AC04-76DP00789;AC07-76ID01570. 5p. (TTC—0820; CONF-881011—14). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88013369/JAW.

From Joint meeting of the European Nuclear Society and the American Nuclear Society; Washington, DC, USA (30 Oct 1988).

A long-term materials evaluation has been initiated at the Idaho National Engineering Laboratory (INEL) in conjunction with an ongoing spent fuel storage cask demonstration program. The objective of the materials testing program is to provide demonstration baseline and operational information that can be used to help verify appropriate preshipment inspections and/or in-service monitoring requirements. The Transnuclear TN-24P storage cask at INEL, which is loaded with consolidated spent fuel, will provide an actual dry storage test environment. 3 refs., 1 tab.

56325 **(SAND—88-2217) Thermal effects of RH-TRU [Remote Handled Transuranic] waste emplacement on WIPP storage room thermal/structural response.** Argeuello, J.G.; Torres, T.M. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1988. Contract AC04-76DP00789. 42p. NTIS, PC A03/MF A01. Order Number DE89001843/JAW.

This report presents the results of a series of two-dimensional (2D) thermostructural analyses performed to evaluate the effects of emplacing Remote Handled Transuranic (RH-TRU) waste in the ribs of a typical waste storage room at the WIPP. A "reference" or baseline case, in which 60 W canisters of RH-TRU are emplaced at 2.44 m (8 ft) centers, is first investigated. Variations to the power output per canister and to the spacing of the canisters are then evaluated to determine their effects on room response. An overall two-dimensional geomechanical model, consisting of two separate 2D idealizations of the configuration, one thermal and one structural, is used to numerically simulate the response of a typical waste storage room at the repository horizon. Results show that for the "reference" condition, the added thermal load has no significant effect on room response and is comparable to the room response for the isothermal case. Furthermore, in varying the power output per canister, a moderate increase in power output, 100 W per canister, resulted in a small increase in room closure, when compared to the baseline response, while a large increase in power output, to 300 W per canister, resulted in a very large increase in room closure. A small increase in canister spacing, from the baseline value, to 3.66 m resulted in a large decrease in room closure, whereas a larger increase in spacing to 6.10 m resulted in only a moderate additional decrease in room closure. 17 refs., 26 figs., 6 tabs.

56326 **(SKB-TR—87-15) Geochemical interpretation of groundwaters from Finnsjoen, Sweden.** Puigdomenech, I.; Nordstrom, K. (Royal Inst. of Tech., Stockholm (Sweden). Dept. of Inorganic Chemistry; Geological Survey, Menlo Park, CA (USA)). (Swedish Nuclear Fuel and Waste Management Co., Stockholm; Geological Survey, Menlo Park, CA (USA)). 23 Aug 1987. 41p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755269/JAW.

Computer calculations with aqueous speciation models (WATEQ3 and EQ3NR) give a picture of the water-rock interactions. The mineral saturation indices of calcite, strontianite, rhodochrosite, and siderite show that the concentration levels of Ca/sup 2+/, Sr/sup 2+/, Mn/sup 2+/ and Fe/sup 2+/ are probably fixed by the aqueous carbonate system and its minerals. However, unreasonably high saturation indices of calcite (up to + 1.7) confirm the uncertainties in the pH-values. Computer simulations with the EQ6 code show that CO/sub 2/(g) outgassing/ingassing might have contributed errors in the pH measurements during the sampling procedure. EQ6 simulations also show that mixing of waters from different aquifers might have induced transient over- or undersaturation of carbonate minerals. Equilibrium between groundwaters and fluorite and barite appear to fix the concentrations of F/sup -/ and Ba/sup 2+/ respectively.

56327 **(SKB-TR—87-29) Alteration of isolating properties of dense smectite clay in repository environment as exemplified by seven pre-quaternary clays.** Pusch, R.; Boergesson, L.; Erlstroem, M. (Sveriges Geologiska AB, Lund). (Swedish Nuclear Fuel and Waste Management Co., Stockholm). Dec 1987. 117p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755271/JAW.

Seven pre-quaternary clays with a smectite content ranging between zero and about 25% were taken as possible reaction products resulting from chemical alteration of dense sodium bentonite. They were characterized with respect to the mineral composition and microstructural constitution and tested with reference to their hydraulic conductivity, swelling ability and creep properties. It was found that since they were all less permeable than a typical large granitic rock mass they would serve as flow barriers in a repository. Thus, even rather extreme chemical attack is not expected to eliminate the most important barrier function of Na bentonite in repository environment. However, slight mechanical disturbance of a heterogeneously altered smectite clay buffer or seal, may be critical. Thus, the investigated, less smectitic clays experienced a rather dramatic increase in hydraulic conductivity on expansion and remolding. This is explained by the inability of a microstructurally discontinuous smectite component - particularly in the Ca-form - to swell and fill voids. The minimum content of Na smectite to preserve the self-healing capacity is estimated at 15-25%. Slight or moderate cementation was indicated by two of the clays by the creep tests. At a smectite content of 15-25% it is probable that self-healing will take place after a mechanically induced breakage of the cementing bonds. The tests gave a good basis for future development of rational, routine tests as well as for a relevant characterization of buffer material candidates.

56328 **(STRIPA-TR—87-14) STRIPA project. Annual report 1986.** (Swedish Nuclear Fuel and Waste Management Co., Stockholm). Aug 1987. 40p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755277/JAW.

A summary of the Stripa Project phase 2 is given. The detailed informations describe crosshole techniques for the detection and characterization of fracture zones, the hydrological characterization of the Stripa site Part II, a three-dimensional migration experiment, borehole, shaft and tunnel sealing, the hydrogeochemical characterization of the Stripa groundwater and question of economy. A decision was taken in principale for an extension of the project into a third phase.

56329 **(UCRL—53873) Plutonium Residue Recovery (PuRR) project: Quarterly progress report, initial report through March 1988.** Pittenger, L.C.; Alire, R.M.; Coops, M.S.; Priest, R.E.; Thompson, D.S.; Condit, R.H.; Burris, L.; Pierce, R.D. (Lawrence Livermore National Lab., CA (USA)). 27 Jun 1988. Contract W-7405-ENG-48. 20p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88016043/JAW.

The PuRR project integrates a number of well understood pyrochemical concepts into one functional process for the recovery of plutonium from scrap and residues. Critical process steps have been identified. Confirming experiments are now in progress at Lawrence Livermore National Laboratory (LLNL) and Argonne National Laboratory (ANL) to demonstrate the successful application of the pyrochemical process described in this document. 3 refs., 12 figs.

56330 **(WHC-SA—0254) CURE [Clean Use of Reactor Energy]: A commercial high-level waste management alternative.** Brager, H.R.; Rawlins, J.A.; Schulz, W.W.; Sloughter, J.P.; Bloomster, C.H. (Westinghouse Hanford Co., Richland, WA (USA)). Jun 1988. Contract AC06-87RL10930;AC06-76RL01830. 7p. (CONF-880903—34). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE89000509/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, USA (11 Sep 1988).

Concern over the future of the US repository program led Westinghouse Hanford Company and Battelle Pacific Northwest Laboratory personnel to form a study group to determine whether partitioning and transmutation (P-T) of actinides and fission products could become a realistic backup option to the permanent geologic disposal of commercial spent fuel. The goal of the group was to identify processes that do not require deep geological permanent storage of waste forms, and to formulate a program plan to demonstrate all the technologies required to meet this goal. 2 figs.

56331 **(WHC-SA—0269) Control of the reduction/oxidation potential of Hanford Waste Vitrification Plant feeds.** Kruger, O.L.; Peterson, M.E. (Westinghouse Hanford Co., Richland, WA (USA)). Feb 1988. Contract AC06-87RL10930. 5p. (CONF-880903—33). NTIS, PC A02/MF A01. Order Number DE89000514/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, USA (11 Sep 1988).

A schematic diagram shows the various processing steps to be performed during feed preparation in the Hanford Waste Vitrification Plant (HWVP). The pretreated NCAW is transferred to the slurry receipt adjustment tank (SRAT) in the HWVP for concentration. Water removed during boildown is collected in the slurry mix evaporator condensate tank (SMECT). After waste treatment the water is returned to the storage tanks for eventual disposal. The pretreated Neutralized Current Acid Waste (NCAW) is concentrated in the SRAT to approximately 125 g waste oxides/ liter. Formic acid is then added at a controlled rate to improve rheological properties and achieve a required reduction/oxidation state. Reflux boiling is initiated and continued for several hours. The concentrated slurry is cooled and pumped to the slurry mix evaporator (SME). In the SME, glass frit is added, and the slurry is further concentrated to achieve a nominal composition of 500 g total oxides/liter. This waste/frit slurry is transferred to a melter feed tank (MFT) and continuously metered to a joule-heated ceramic melter where it is converted into a borosilicate glass. 2 figs.

56332 **(WHC-SA—0271) Cooling joint width and secondary mineral infilling characteristics in four Grande Ronde Basalt flows at the Hanford Site, Washington.** Lindberg, J.W. (Westinghouse Hanford Co., Richland, WA (USA)). Sep 1988. Contract AC06-87RL10930. 57p. (CONF-8705153—2). NTIS, PC A04/MF A01. Order Number DE89001117/JAW.

From Geological Society of American Cordilleran section meeting; Hilo, HI, USA (20 May 1987).

Widths were measured and percentages of secondary mineral infilling types were estimated 3194 cooling joints in basalt core of the Rocky Coulee, Cohassett, McCoy Canyon, and Umtanum basalt flows. The core was from core holes RRL-2, RRL-6, RRL-14, and DC-16 on the Hanford Site in Washington State. Joint width was characterized by determining the frequency distribution in each of 16 flow/core hole combination samples (4 flows by 4 core holes = 16 samples) and comparing the distributions between intraflow structures, between basalt flows, and between core holes. Joint infilling was characterized by determining the percentage of joints with each secondary mineral type present and then comparing

flows and comparing intraflow instructures. Basalt flows, intraflow structures, and core holes cannot be differentiated consistently on the basis of joint width. There is only one population of widths that can be characterized by a log-normal distribution, an arithmetic mean of 0. 23 mm(9.0E-04in.), and a standard deviation of 0.49 mm (1.9E-03in.). Clay is the predominant infilling type followed by silica and zeolite. For example, 98.1% of the randomly selected joints from the Cohassett flow are filled predominately with clay, 6.5% have zeolite predominating, and 4.0% have silica predominating. Only 19(0.6%) of the 3194 joints measured have observable void space. Basalt flows and intraflow structures cannot be differentiated on the basis joint infilling types, except for the Umtanum entablature. Joint width and infilling types are correlated, and secondary minerals fill basalt cooling joints in a particular sequence.

56333 **(WHC-SA—0274) Intraflow structures of the Cohassett flow at east Sentinel Gap and Sentinel Mountain.** Cross, R.W.; Fairchild, K.R. (Westinghouse Hanford Co., Richland, WA (USA)). Apr 1988. Contract AC06-87RL10930. 54p. NTIS, PC A04/MF A01. Order Number DE89000475/JAW.

This report presents the results of outcrop intraflow structure studies in the Cohassett flow at east Sentinel Gap and Sentinel Mountain on the northwestern margin of the Pasco Basin. This study is the first of several Cohassett outcrop studies. The studies will aid in characterizing intraflow structures of the Cohassett flow to support design and construction and to aid in assessing the performance of a possible high-level nuclear waste repository in the subsurface of the reference repository location at the Hanford Site. A total of twenty-four intraflow structure sections of the Cohassett flow were measured at two, adjacent study areas. The measured sections provide positions, thicknesses, and descriptions of every intraflow structure encountered within the Cohassett flow. Graphic logs of each section display the sequence of intraflow structures per measured section. Correlation diagrams depict interpretations of the lateral continuity and thickness variations of each intraflow structure across the total of 6 km of the two study areas. Consistencies of intraflow structures are observed across the study area. The Cohassett flow interior in outcrop is consistently thick and never thins to less than 51 m. The flow interior is interpreted as laterally continuous across the study areas, and no features are observed to interrupt its horizontal extent. Based on the field observations, there is interpreted lateral continuity of packets of intraflow structures within the flow interior. 20 refs., 24 figs.

56334 **(WHC-SA—0319) Modeling of hydrologic perturbations during reverse circulation drilling: 1, System and model description.** Sagar, B.; Connelly, M.P.; Long, P.E. (Westinghouse Hanford Co., Richland, WA (USA)). May 1988. Contract AC06-87RL10930;AC06-76RL01830. 21p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE89001077/JAW.

The Hanford site located in southeastern Washington state was under consideration for the location of a high-level nuclear waste repository. As a part of site investigation, a borehole of depth > 3000 ft was drilled using reverse circulation drilling technique with water as the drilling fluid. After completion of drilling, seven piezometers were to be installed in the borehole with their lower ends at different depths to measure equilibrated hydraulic heads and aquifer response during future pumping tests. The hydrologic perturbations caused during the drilling, clean up, and piezometer installation process were of primary concern. A numerical model was used to predict these perturbations and determine efficiency of borehole cleanup. It was found that the boundary condition at the borehole was the most difficult to model. 9 refs., 5 figs.

56335 **(WHC-SA—0347) Adjoint-state and sensitivity coefficient calculation in multilayer aquifer system.** Lu, A.H.; Wang, C.; Yeh, W.W.G. (Westinghouse Hanford Co., Richland, WA (USA)). Jun 1988. Contract AC06-87RL10930. 9p. (CONF-880672—4). NTIS, PC A02/MF A01. Order Number DE89001112/JAW.

From 7. international conference on computation methods in water resources; Cambridge, MA, USA (13 Jun 1988).

In this paper, a computational code using the variational method has been developed to calculate the sensitivity coefficients. The sensitivity coefficients are defined as the deriative of the hydraulic head with respect to the hydraulic conductivities. Both the three-dimensional flow equations and the adjoint sensitivity equations are solved using a method which combines the local mass balance and finite element approximation. The code is designed for use as a module for parameter estimation by incorporating a generalized least-squares algorithm. The developed methodology is especially suitable for a large number of groundwater parameter estimations for which limited number of measurements may exist. The computational advantage and applications of the developed code will be discussed.

56336 **Sequential estimation of aquifer parameters.** Lu, A.H.; Schmittroth, F.; Yeh, W.W.G. (Westinghouse Hanford Company, Richland, WA (USA)). *Water Resources Research;* **24**: No. 5, 670-682(May 1988).

A two-dimensional inverse or parameter estimation code was developed for use in the Basalt Waste Isolation Project site characterization program. The method uses a sequential least square algorithm that incorporates a finite element ground water flow code. Adjoint equations and flow equations are solved to provide an efficient calculation of sensitivity coefficients. The least square algorithms are formulated to sequentially include the output information for updating a priori parameter estimates. Several cases were studied to demonstrate the methodology developed; included were an analysis of pumping from a single well and a sequential analysis in which results obtained by pumping from one well were combined with an analysis of pumping from a second well. The approach emphasizes the sequential nature of the problem whereby the characterization of site hydrology can be systematically improved.

56337 **Environmental biotechnology: Reducing risks from environmental chemicals through biotechnology.** Omenn, G.S. (ed.). New York, NY; Plenum Press (1988). 489p. (CONF-870794—). Plenum Press, 233 Spring Street, New York, NY 10013. Order Number TI88016496/JAW. Contract FG06-87ER60591.

From Reducing risks from environmental chemicals through biotechnology; Seattle, WA, USA (19 Jul 1987).

This book contains 34 papers on various aspects of hazardous waste management through biotechnology. The articles stress the three basic strategies of waste management; minimize the amount of waste generated; reduce the toxicity of the wastes; and find more satisfactory ways of disposing of wastes. Part I of this collection describes the use of microbial ecology, molecular biology, and other scientific disciplines to combat these problems. Part II describes the application of present technology to current problems. Part III describes the effect of policy and regulations on biotechnology. Individual papers are processed separately for the data base. (TEM)

56338 **Improved method and composition for immobilization of waste in cement-based material.** Tallent, O.K.; Dodson, K.E.; McDaniel, E.W. US Patent Application 6-103,149. 1 Oct 1987. 16p. Contract AC05-84OR21400. NTIS, PC A03/MF A01.

A composition and method for fixation or immobilization of aqueous hazardous waste material in cement-based materials (grout) is disclosed. The amount of drainable water in the cured grout is reduced by the addition of an ionic aluminum compound to either the waste material or the mixture of waste material and dry-solid cement- based material. This reduction in drainable water in the cured grout obviates the need for large, expensive amounts of gelling clays in grout materials and also results in improved consistency and properties of these cement-based waste disposal materials.

56339 **Precipitate hydrolysis process for the removal of organic compounds from nuclear waste slurries.** Doherty, J.P.; Marek, J.C. US Patent Application 6-018,389. 25 Feb 1987. 21p. Contract AC09-76SR00001. NTIS, PC A03/MF A01.

A process for removing organic compounds from a nuclear waste slurry comprising reacting a mixture of radioactive waste precipitate slurry and an acid in the presence of a catalytically effective amount of a copper(II) catalyst whereby the organic com-

pounds in the precipitate slurry are hydrolyzed to form volatile organic compounds which are separated from the reacting mixture. The resulting waste slurry, containing less than 10 percent of the original organic compounds, is subsequently blended with high level radioactive sludge land transferred to a vitrification facility for processing into borosilicate glass for long-term storage. 2 figs., 3 tabs.

56340 Geochemical simulation of dissolution of West Valley and DWPF glasses in J-13 water at 90C. Bruton, C.J. (Lawrence Livermore National Lab., CA (USA)). pp 607-619 of Scientific basis for nuclear waste management 11: Volume 112: Proceedings. Apted, M.J.; Westerman, R.E. (eds.). Pittsburgh, PA; Materials Research Society (1987). (CONF-8711100—). Contract W-7405-ENG-48.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (30 Nov 1987).

Dissolution was simulated using the EQ3/6 computer code package. The objectives of the study were to attempt to predict the concentrations of radionuclides and other glass components in solution resulting from glass dissolution, and to identify potential precipitates that sequester glass components. Simulation results predict that radionuclides and other glass components precipitate predominantly in the form of oxides and hydroxides, together with carbonates, silicates and phosphates. Precipitates appear to be effective in limiting the concentrations of radionuclides and other elements in solution. Concentrations of elements released from glass increase until the solution reaches saturation with respect to solids that contain these elements. Elemental concentrations are then predicted to remain constant, increase or decrease depending on: (1) whether the reaction between the dominant aqueous species of the element in solution and its precipitate is pH and/or Eh-dependent; (2) whether the species distribution of the element in solution changes significantly in response to changes in pH, Eh, or other factors; and (3) the competition with other phases for elements required to form the precipitate. pH increases from 7.3 to 9.8 and from 7.2 to 10 in the West Valley and DWPF simulations, respectively. Eh decreases abruptly from about 0.5 to 0.3 volts after dissolution of 3.4 and 5.8 grams of glass in the West Valley and DWPF simulations, respectively, because of depletion of dissolved oxygen in solution. Complexing of aqueous species has a significant impact on radionuclide concentrations in solution; predicted concentrations of U in solution, for example, are controlled by the presence or absence of P in solution because H_3PO_4 is an extremely effective complexing agent for U. 20 references.

56341 Ocean dumping of low-level radioactive waste. Hunsaker, C.T. (Oak Ridge National Lab., TN (USA)). *Environmental Forum;* 1-8(Nov 1984).

Ocean dumping of low-level radioactive waste in the US is regulated by EPA, as authorized by the MPRSA. Other US laws and regulations applicable to ocean dumping of radioactive waste include the Hazardous Materials Transportation Act, The National Environmental Policy Act, The Atomic Energy Act, and the Energy Reorganization Act, along with internal orders for executive departments such as the US DOE. The major international agreement on ocean dumping is the Convention of the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Dumping Convention), which prohibits the disposal of high-level wastes and requires a special permit prior to ocean disposal of other wastes. Several international organization focus on radioactive waste management; the International Atomic Energy Agency and the Nuclear Energy Agency are the largest and most active. Because the US is a member of the IAEA and a party to the London Dumping Convention, EPA will have to make US regulations under MPRSA agree with international policy. 6 references, 1 figure.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 56198, 56200, 56207, 56225, 56226, 56227, 56228, 56229, 56231, 56239, 56240, 56241, 56242, 56243, 56244, 56245, 56248, 56252, 56254, 56255, 56265, 56266, 56267, 56269, 56270, 56271, 56284, 56285, 56289, 56291, 56292, 56293, 56295, 56296, 56297, 56298, 56299, 56301, 56302, 56303, 56304, 56305, 56306, 56307, 56308, 56309, 56312, 56313, 56314, 56315, 56316, 56317, 56318, 56319, 56320, 56321, 56322, 56323, 56324, 56325, 56330, 56331, 56332, 56333, 56335, 56337, 56353, 57348, 57537, 57541

0540 Health And Safety

REFER ALSO TO CITATION(S) 56198, 56200, 56250, 56356, 56648, 56653, 56656, 56657, 56658, 56659, 56660, 56661, 56662, 56663, 56671, 56672, 57588, 57601

56342 (DOE/ID/12584—25) Exposure-rate calibration using large-area calibration pads. Novak, E.F. (UNC Geotech, Grand Junction, CO (USA)). Sep 1988. Contract AC07-86ID12584. 21p. (UNC/GJ—42(TMC)). NTIS, PC A03/MF A01. Order Number DE89001068/JAW.

The US Department of Energy (DOE) Office of Remedial Action and Waste Technology established the Technical Measurements Center (TMC) at the DOE Grand Junction Projects Office (GJPO) in Grand Junction, Colorado, to standardize, calibrate, and compare measurements made in support of DOE remedial action programs. A set of large-area, radioelement-enriched concrete pads was constructed by the DOE in 1978 at the Walker Field Airport in Grand Junction for use as calibration standards for airborne gamma-ray spectrometer systems. The use of these pads was investigated by the TMC as potential calibration standards for portable scintillometers employed in measuring gamma-ray exposure rates at Uranium Mill Tailings Remedial Action (UMTRA) project sites. Data acquired on the pads using a pressurized ionization chamber (PIC) and three scintillometers are presented as an illustration of an instrumental calibration. Conclusions and recommended calibration procedures are discussed, based on the results of these data.

56343 (DOE/ID/12584—26) Year-long comparison of two techniques to monitor outdoor radon concentrations at Shiprock, New Mexico. Novak, E.F. (UNC Geotech, Grand Junction, CO (USA)). Aug 1988. Contract AC07-86ID12584. 29p. (UNC/GJ—43(TMC)). NTIS, PC A03/MF A01. Order Number DE89001021/JAW.

The US Department of Energy (DOE) Office of Remedial Action and Waste Technology established the Technical Measurements Center (TMC) at the DOE Grand Junction Projects Office (GJPO) in Grand Junction, Colorado, to standardize, calibrate, and compare measurements made in support of DOE remedial action programs. Outdoor radon concentration measurements were made by the TMC in Shiprock, New Mexico, to compare two different methods of measuring radon in an attempt to determine the feasibility of using passive alpha-track detectors to assess the adequacy of remedial action undertaken at the Shiprock uranium mill tailings pile. The results of the first three quarters of monitoring have been detailed in previous reports. An analysis of the data from the fourth quarter of monitoring at Shiprock reveals a somewhat poorer correlation between the two sets of measurements than was seen in the third quarter of this study, but a better correlation than was found for the first and second quarters. The results of a nearly year-long exposure of alpha-track detectors were in much better agreement with the annual-average results of the second measurement method than were any of the quarterly results. The results of a calibration exposure of several alpha-track detectors in an environmentally controlled radon chamber differed significantly from the detector manufacturer's calibrations. The most significant conclusion is that alpha-track detectors require a year-long exposure to provide a reliable estimate of the annual-average outdoor radon concentration. Annual averages calculated from quarterly exposures are more prone to errors occurring during the track-counting process. 7 refs., 5 figs., 5 tabs.

56344 (NUREG/CP—0086-Vol.2, pp 688-705) **Aerosol-source term in the head-end-dissolver off-gas of a reprocessing plant.** Furrer, J.; Linek, A.; Krissel, R.; Jannakos, K.; Herrmann, F.J.; Nemes, B. (Kernforschungszentrum Karlsruhe GmbH (West Germany)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

To demonstrate an advanced dissolver off-gas cleaning system, the PASSAT prototype filter system and the WAESCHE off-gas simulation facility have been developed, modified, and coupled together for operation. The WAESCHE facility consists of a dissolver, a condenser, and an NO/sub x/-scrubber and serves to simulate and study the aerosol and iodine formation, behavior, and distribution in the head-end under realistic conditions. The report describes the aerosol distribution during simulated shear and dissolver operations in the WAESCHE-PASSAT dissolver off-gas simulation and treatment facility. Also the aerosol concentration and removal was measured in the Karlsruhe Reprocessing Plant in hot operation during several dissolutions of spent fuel elements.

56345 (NUREG/CP—0086-Vol.2, pp 706-716) **Aerosol retention of a dissolver off-gas system.** Nagel, K.; Furrer, J. (Kernforschungszentrum Karlsruhe GmbH (West Germany)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

Many investigations were done for nuclear reprocessing plants, where the dissolver off-gas system has been considered thoroughly. The Nuclear Research Center Karlsruhe has performed important experiments in this field which revealed valuable results. Based on these experimental results it was promising to model off-gas cleaning components. First aerosol retention models have been developed for a wave plate droplet separator and a packed fiber mist eliminator. Now experiments about the NO_2-scrubber became known, which allowed to model its retention factor. Recent investigations led to comparisons between the experimentally determined aerosol retention factors and the calculated factors for these three off-gas components.

56346 (NUREG/CP—0086-Vol.2, pp 717-729) **Partitioning of iodine in off-gas generated by dissolution of spent nuclear fuel.** Birdwell, J.F.; Weber, F.E. (Oak Ridge National Lab., TN (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

A computer simulation of a dissolver offgas scrubbing system has been developed in order to study iodine retention in the liquid phase throughout the system. In addition, the effects of steam stripping and air sparging on iodine accumulation have been investigated. The model includes determinations of vapor/liquid iodine partitioning and NO/sub x/ removal in an absorption column. The results of the simulations indicate that iodine is retained in the liquid phase at levels on the order of 10^{-5} gmol/liter. Sparging and steam stripping both reduce the liquid-phase concentration of iodine in the system. The greatest reduction in liquid-phase iodine retention observed in the simulations was approximately 35%. Unfortunately, the use of an air sparge to volatilize iodine (which it does quite effectively) causes a decrease in NO/sub x/ scrubbing efficiency by lowering the concentration of NO/sub x/ in the scrubbing column vapor. However, NO/sub x/ removal efficiencies were determined to exceed 90% in all flow sheets simulated.

56347 (NUREG/CP—0086-Vol.2, pp 730-738) **Behavior of a sorbent material (AC 6120) for iodine removal in the presence of nitrogen oxide.** Maurel, J.M.; Vigla, D. (CEN/Saclay, Gif sur Yvette (France)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

In the new French reprocessing plants the plan is to complete iodine removal in the gaseous effluents by selective trapping on a solid material. A study covering the use, at industrial scale, of a product consisting of silica impregnated with silver nitrate (AC 6120) has already been made using simulated effluents which do not contain nitrogen oxides. The aim of this study is to determine the changes in the performance of the AC 6120 product due to the presence of nitrogen oxides. The nitrogen oxides depending on their chemical form (NO or NO_2) have an influence on the silver nitrate impregnation material. Laboratory experiments using the test loop named Tanox have shown: (1) the change in total iodine retention capacity of the material as a function of the ratio NO_2/NO and the total amount of nitrogen oxides, and (2) the variation of the absorption kinetic of the iodine as a function of the degradation of the material. This paper presents the first part of the study relative to the influence of NO alone.

56348 (NUREG/CP—0086-Vol.2, pp 739-748) **Thoron filter design for the off-gas line of the ITREC reprocessing plant.** Candelieri, T.; Curzio, G.; Mori, A. (E.N.E.A. Trisaia (Italy)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

Operational tests of the ITREC reprocessing plant have shown some problems on the monitoring of beta-gamma emitters at the stack; the alarm threshold was reached within a few minutes, from the beginning of the fuel reprocessing steps. Nevertheless, this getting over was not attributable to beta - gamma emitter particulates which were not retained by the absolute filters of the off-gas line, but to the interference of the short lived radioactive particulate thoron daughters for which the limit of discharge is a thousand times higher. With the aim of avoiding such spurious alarms the authors examined the possibility of inserting a charcoal delay bed for reducing thoron concentration to an acceptable level by natural decay. The decontamination factor that the decay bed must satisfy depends on the decay constant of ^{220}Rn and daughters. This can be evaluated from the characteristics of the measuring device on the basis of the off-gas flow rate, stack flow rate and monitoring line sampling flow rate. Dynamic adsorption characteristics of a selected charcoal were experimentally determined by the pulse technique and are reported in this paper. Finally sizing criteria are outlined and the filter design is shown.

56349 (NUREG/CP—0086-Vol.2, pp 749-766) **Demonstration of the iodine and nitrogen oxide removal systems in the Oak Ridge National Laboratory integrated equipment test facility.** Jubin, R.T.; Lewis, B.E. (Oak Ridge National Lab., TN (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2). Contract AC05-84OR21400.

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

As part of the Consolidated Fuel Reprocessing Program, the Integrated Equipment Test (IET) facility, which was conceived in 1976 for developing and demonstrating both process and remote maintenance features of a modern fuel reprocessing facility, was completed and became fully operational in 1984. The IET has two major demonstration areas, the Integrated Process Demonstration (IPD) and Remote Operations and Maintenance Demonstration. The overall objective of the IPD is to demonstrate the integrated operation of separately developed equipment and processes prototypical of those expected to be deployed in advanced reprocessing plants. The IPD engineering-scale process equipment simulates all the head-end operations through the first cycle of the Purex flowsheet modified for advanced fuel reprocessing. Experiments were conducted in the IPD facility with the objectives of (1) evaluating the performance of the double overhead condenser design for the recycle of condensate and passage of iodine in the dissolver off-gas system (DOG), (2) determining the saturation levels and concentration of condensables in the off-gas from the rotary dissolver under a variety of conditions including the dissolution of both UO_2 and U_3O_8, (3) using the data obtained from the NO/sub x/ system to verify column design, and (4) performing a total system iodine and acid balances. The paper describes the results from these tests.

56350 (NUREG/CP—0086-Vol.2, pp 767-774) **Experimental evaluation of nitrogen oxides and iodine retention during the scrubbing of dissolver off-gas.** Counce, R.M.; Groenier, W.S.; Jubin, R.T. (Oak Ridge National Lab., TN (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2). Contract AC05-84OR21400.

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

As part of the Consolidated Fuel Reprocessing Program, this study was conducted at the Oak Ridge National Laboratory to investigate the removal of nitrogen oxides from simulated dissolver off-gas, a gas blended to simulate that arising from the dissolution of nuclear fuel in reprocessing operations. Dissolver off-gas contains large quantities of water vapor and nitrogen oxides and much smaller quantities of iodine and other fission product gases. It is desirable to recover the nitrogen oxides by absorption into water, where subsequent reactions produce nitric acid, which may be recycled to dissolution operations. The NO/sub x/ scrubber system was operated in a mode thought to be prototypic of a dissolver off-gas NO/sub x/ scrubber system for nuclear fuel reprocessing facilities, including recycle of the scrubbing liquid. Chemical reactions occurring simultaneously with the absorption of NO/sub x/ into dilute HNO_3 solutions produce liquid HNO_3 and HNO_2. In general, the presence of HNO_3 in dilute concentrations in the scrub solution does not have a significant effect on NO/sub x/ scrubbing efficiency; however, the presence of HNO_2 in this solution does have a significant deleterious effect on NO/sub x/ scrubbing efficiency. In the results reported here, NO/sub x/ scrubbing efficiency is shown to increase when the HNO_2 content of the scrub solution is reduced by oxidation with O_2 or H_2O_2. In other experiments involving the presence of I_2 in the feed gas, the I_2 content of the recycled scrub solution increased to a steady-state value. At this condition, the bulk of the gaseous I_2 passes through the NO/sub x/ scrubber system.

56351 (NUREG/CP—0086-Vol.2, pp 775-785) **Environmental test chamber for demonstrating in-cell cleanup of fuel reprocessing plant atmospheres.** Spencer, B.B. (Oak Ridge National Lab., TN (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2). Contract AC05-84OR21400.

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

As part of an overall research and development program sponsored by the Consolidated Fuel Reprocessing Program at the Oak Ridge National Laboratory, a low-flow ventilation system is under development to remove process heat from the large process cells of a nuclear fuel reprocessing plant and to clean the cell gas of certain corrosive contaminants. A detailed mathematical simulation has been developed showing that the system performs as intended. An environmental test chamber has been built to demonstrate the concept on a meaningful scale.

56352 (NUREG/CP—0086-Vol.2, pp 981-1001) **Continuous integrated iodine-129, carbon-14, antimony-125, tritium, and krypton-85 off-gas monitor for nuclear fuel reprocessing plants.** McManus, G.J.; Fernandez, S.J.; Motes, B.G. (Westinghouse Idaho Nuclear Co., Idaho Falls (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

Reported is the development of a new integrated off-gas monitor for measurement of radionuclide releases at the Idaho Chemical Processing Plant. The monitor is designed for simultaneous separation, collection and/or analysis of selected effluents on a continuous basis. Included are capabilities for real-time measurements of ^{85}Kr and ^{3}H and time-integrated collection of ^{125}Sb, ^{129}I, and ^{14}C. While techniques are available for the measurement of the various individual radionuclides, no integrated capability is available for the simultaneous monitoring of all five radionuclides. This is accomplished by the use of a unique three train sampling system.

56353 (NUREG/CP—0086-Vol.2, pp 1095-1115) **Environmental contamination from a ground-level release of fission products.** Stupka, R.C.; Kephart, G.S.; Rittmann, P.D. (Rockwell Hanford Operations, Richland, WA (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

On January 11, 1985, a ground-level release of fission products, primarily ^{90}Sr, occurred at the Hanford Site in southeastern Washington State. The release was detected during routine surveys and the majority of the contamination was confined to the immediate area where the release occurred. Response to the incident was complicated by a strong inversion that resulted in a buildup of ^{222}Rn daughter products on environmental air samples and outdoor surfaces. The cause of the release appears to have been the operation of a transfer jet that inadvertently pressurized an unblanked line leading to the 241-C-151 Diversion Box. A buildup of pressure inside the diversion box forced contaminated air through gaps in the diversion box cover blocks resulting in an unmonitored, short duration release to the environment. The source term was estimated using data obtained from environmental air samplers. The ground deposition speed was calculated using the integrated exposure (air samples) and surface contamination levels obtained from recently fallen snow. The total release was estimated to be 1.4 Ci ^{90}Sr and 0.02 Ci ^{137}Ci. Based on this source term, the maximum 50-yr dose commitment to onsite personnel was 50 mrem whole body and 600 mrem bone. No detectable internal deposition occurred during the incident and corrective action which followed.

56354 (NUREG/CP—0086-Vol.2, pp 1189-1195) **Alternative approach to nuclear air cleaning in waste repositories.** Holub, R.F. (Bureau of Mines, Denver, CO (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

The Bureau of Mines has been developing an air cleaning system to remove radioactive aerosols from underground uranium mine atmospheres. The basic properties of the Bureau's system are: (1) a relatively low-cost filter medium with a long, useful life, (2) an efficiency exceeding 95% in removing radioactive aerosol, and (3) a low pressure drop across filter elements. The system has been successfully tested in the Twilight Mine radiation facility and in an active uranium mine in Utah. Test results of the system are given.

0550 Safeguards, Inspection, And Accountability

REFER ALSO TO CITATION(S) 56277, 56301

56355 (ANSTO/PM—2) **Nuclear materials management procedures.** Veevers, K.; Silver, J.M.; Quealy, K.J.; Steege, E. van der. (Australian Nuclear Science and Technology Organisation, Lucas Heights). Oct 1987. 25p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703951/JAW.

This manual describes the procedures for the management of nuclear materials and associated materials at the Lucas Heights Research Laboratories. The procedures are designed to comply with Australia's nuclear non-proliferation obligations to the International Atomic Energy Agency (IAEA), bilateral agreements with other countries and ANSTO's responsibilities under the Nuclear Non-Proliferation (Safeguards) Act, 1987. The manual replaces those issued by the Australian Atomic Energy Commission in 1959, 1960 and 1969.

56356 (CONF-881054—15) **Environmental Sampling Technician Training Program.** Moreland, W.M. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01. Order Number DE89001519/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

The Oak Ridge National Laboratory (ORNL) is currently involved in extensive environmental monitoring activities to charac-

terize various active/inactive waste sites that exist at the facility. There are also considerable reporting requirements that ORNL must meet on a continuing basis in order to remain in compliance with existing permit requirements under the Resource Conservation and Recovery Act (RCRA), the Clean Air Act (CAA), and the Clean Water Act (CWA). Much of the environmental monitoring data that is used to characterize waste sites or is required in reports is obtained by environmental sampling technicians who must take samples at various locations throughout ORNL as well as other DOE installations. Because of the quality control and assurance measures included under NQA-1, ORNL has developed an Environmental Sampling Technician Training Program. This presentation will describe how the Environmental Sampling Technician Training Program was developed and will review the specific materials used in conducting the training. 8 refs., 2 tabs.

56357 **(LA-UR—88-3190) Los Alamos safeguards program overview and NDA in safeguards.** Keepin, G.R. (Los Alamos National Lab., NM (USA)). [1988]. Contract W-7405-ENG-36. 32p. (CONF-8809147—1). NTIS, PC A03. Order Number DE89000314/JAW.

From 20. anniversary symposium of the Technical Support Organization; Upton, NY, USA (25 Sep 1988).

Over the years the Los Alamos safeguards program has developed, tested, and implemented a broad range of passive and active nondestructive analysis (NDA) instruments (based on gamma and x-ray detection and neutron counting) that are now widely employed in safeguarding nuclear materials of all forms. Here very briefly, the major categories of gamma ray and neutron based NDA techniques, give some representative examples of NDA instruments currently in use, and cite a few notable instances of state-of-the-art NDA technique development. Historical aspects and a broad overview of the safeguards program are also presented.

56358 **(WHC-SA—0238) Overview of the US Department of Energy Master Safeguards and Security Agreement program.** Billings, M.P.; Duncan, M.R.; Craig, J.R. (Westinghouse Hanford Co., Richland, WA (USA)). Jun 1988. Contract AC06-87RL10930. 12p. (CONF-880631—51). NTIS, PC A03/MF A01. Order Number DE89000513/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

The Master Safeguards and Security Agreement establishes a contract between the US Department of Energy-Headquarters and a US Department of Energy regional Operations Office regarding protection strategies, protection system performance, and acceptability of risks for US Department of Energy Safeguards and Security interests at a facility or site. An approved Master Safeguards and Security Agreement defines the protection system performance baseline for evaluations, inspections, and audits, and can introduce exceptions to US Department of Energy orders. Responsibilities and authorities for development and approval of a Master Safeguards and Security Agreement are outlined in US Department of Energy Order 5630.13, "Master Safeguards and Security Agreement" and US Department of Energy Order 5630.xx, "Safeguards and Security Planning Program" (draft). To date, 14 Master Safeguards and Security Agreements have been approved by the US Department of Energy-Headquarters and about 34 are in preparation or review. A total of approximately 50 are anticipated before completion of the program. The Master Safeguards and Security agreement program has been positively received by both the US Department of Energy-Headquarters and the US Department of Energy Operations Offices, because it provides visibility as to the effectiveness of Safeguards and Security protection systems and affords a sensible foundation for security planning based on risk. 6 refs., 3 figs., 6 tabs.

56359 **(WHC-SA—0261) Using detection and deterrence to reduce insider risk.** Eggers, R.F.; Carlson, R.L.; Udell, C.J. (Westinghouse Hanford Co., Richland, WA (USA)). Jun 1988. Contract AC06-87RL10930. 7p. (CONF-880631—55). NTIS, PC A02/MF A01. Order Number DE89000512/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

This paper addresses a new concept of interaction between adversary detection and deterrence. It provides an initial evaluation of the effects of these variables on the risk of theft of special nuclear material by an insider adversary and can be extended to the sabotage threat. A steady-state risk equation is used. Exercises with this equation show that deterrence, resulting from the prospect of detection, has a greater ability to reduce the risk than the detection exercise itself. This is true for all cases except those in which the probability of detection is 1. Cases were developed for three different types of adversaries that can be distinguished from one another by the level of detection they are willing to tolerate before they are deterred from attempting a theft. By considering the effects of detection, deterrence, and adversary type, the ground work is laid for designing cost-effective insider threat-protection systems. 2 refs., 6 figs.

0560 Legislation And Regulations

REFER ALSO TO CITATION(S) 56218, 56289

56360 **(INIS-BR—1230) International responsability of state by the deleterius effects of ionising radiation.** Faria, N.M. de. (Universidade do Estado do Rio de Janeiro (Brazil)). 1988. 191p. (In Portuguese). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704022/JAW.

International Responsability of State, considering the deleterius effects of ionising radiation on the human being, property, territory and environment which are under other jurisdiction, is focused. Conventional rules, costumary rules, the evolution of "opinion juris" as well as the decisions of tribunals related to the subject are analysed.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

56361 **(INPE—4243) Plasma centrifuge development at Spatial Research Institute (INPE).** Bittencourt, J.A.; Del Bosco, E.; Dallaqua, R.S.; Ludwig, G.O. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Jul 1987. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704034/JAW.

Thre plasma centrifuge is a device in which a fully ionized plasma column rotates at high angular velocities by means of crossed electric and magnetic fields. Ion angular rotation frequencies have been measured for a carbon plasma with an externally applied magnetic field. Isotopic enrichments of up to 390% for /sup 13/C have been measured de 6 cm radius. The steady state hehavior of the fully ionized magnetized plasma in the vacuum-arc centrifuge has been theoretically investigated using a multile species fuel model, which includes electromagnetic, pressure-gradient, centrifugal and collisional forces in cylindrical geometry.

56362 **(INPE—4509) Vacuum-arc plasma centrifuge experiment.** Del Bosco, E.; Dallaqua, R.S.; Bittencourt, J.A.; Ludwig, G.O. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). May 1988. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704051/JAW.

Vacuum-arc plasma centrifuges, for isotope and element enrichment, have been studied to some extent over the last 10 years. This paper describes the vacuum-arc plasma centrifuge developed at INPE. The experiment is characterized by its relative small dimensions. Angular rotation frequencies in the range of 1.9 x 10/sup 5/ rad/s to 3.5 x 10/sup 5/ rad/s, measured with Langmuir probes, are presented for a magnesium plasma. Enrichments of 15% for /sup 25/Mg and 26% for /sup 26/Mg were measured with a quadrupole mass spectrometer. The dependence of magnesium isotope enrichments upon the magnetic field is also presented.

56363 (UJV—8034-CH,B, pp 13-16) **Czechoslovak experience with /sup 99/Tc extraction.** Prokop, I.; Budsky, F.; Sistek, I. Sep 1987. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704162/JAW. (CONF-8612161—).

From 4. international symposium of CMEA countries on radiopharmaceuticals and RIA kits; Obninsk, USSR (16 Dec 1986).

/sup 99m/Tc for the needs of Prague nuclear medicine departments is produced by UJV Rez which despatches it every day to a distribution centre in Prague. The preparations are packaged by 2.5, 5 and 10 ml and have a specific activity of 800 MBq/ml. The parameters of the preparations and the volume of production since 1979 are given. Three clinical departments performed tests of miniaturized extraction generator EGTC-30 producing an activity of 7.5 to 22 GBq of /sup 99/Mo. The use of the generators is efficient for high /sup 99/Mo activities (above 10 MBq). (E.S.). 2 tabs.

56364 (UJV—8034-CH,B, pp 5-9) **U-120 M cyclotron potential of producing radiopharmaceuticals to meet Czechoslovak needs.** Kopecky, P.; Melichar, F. Sep 1987. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704162/JAW. (CONF-8612161—).

From 4. international symposium of CMEA countries on radiopharmaceuticals and RIA kits; Obninsk, USSR (16 Dec 1986).

The programme of research and production of radiopharmaceuticals by the Nuclear Research Institute for the years 1980 to 1990 is centred around the start of production of preparations labelled with /sup 67/Ga, /sup 111/In, /sup 123/I, and /sup 201/Tl. Lists are presented of the needs of Czechosloak institutions for injectable /sup 67/Ga-gallium citrate, /sup 201/Tl-thallium chloride and /sup 111/In-chloride, oxinate and thiomycin. /sup 123/I-labelled radiopharmaceuticals have not yet been applied in Czechoslovakia. The irradiation conditions and time cycles are shown for the production of the radionuclides /sup 67/Ga, /sup 111/In, /sup 123/I, and /sup 201/Tl, the schedule and production volumes for /sup 201/Tl-chloride, /sup 67/Ga-citrate, /sup 111/In-chloride, and Na/sup 123/I. (J.B.). 7 tabs.

0702 Radiation Sources

56365 (CONF-880911—21) **The Advanced Neutron Source Facility: A new user facility for neutron research.** West, C.D. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 19p. NTIS, PC A03/MF A01. Order Number DE89000640/JAW.

From International reactor physics conference; Jackson Hole, WY, USA (18 Sep 1988).

The Advanced Neutron Source (ANS) is a new reactor-based research facility being planned by Oak Ridge National Laboratory (ORNL) to meet the need for an intense steady state source of neutrons and for associated research space and equipment. The ANS will be open for use by scientists from universities, industry, and other federal laboratories. The ANS will be built around a new research reactor of unprecedented flux; that is, it will produce the most intense continuous beams of neutrons in the world. The goal is to reach a thermal neutron flux for beam experiments of 5 {times} 10^{19} to 10 {times} 10^{19} neutrons/(m^2{center←dot}s/sup {minus}1/). By combining the higher source flux with improved experimental facilities, the ANS will surpass current US high flux reactors---the High Flux Isotope Reactor (HFIR) at ORNL and the High Flux Beam Reactor (HFBR) at Brookhaven National Laboratory---by a factor of 10 to 20. The safety analysis of the ANS facility will include a complete probabilistic risk assessment (PRA), which will provide a systematic assessment of dependencies among systems at the malfunctions. For the current generation of nuclear power plants that have recently undergone the licensing review process, PRA has been used an an analysis tool after completion of the plant designs. For the ANS Project, the PRA effort has already begun, before the facility conceptual design. This allows safety insights from the PRA to be incorporated into the evolving plant design. 4 refs., 6 figs.

56366 (CONF-8806236—2) **Laser-driven polarized sources of hydrogen and deuterium.** Young, L.; Holt, R.J.; Green, M.C.; Kowalczyk, R.S. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 5p. NTIS, PC A02/MF A01. Order Number DE89000541/JAW.

From First European workshop on hadronic physics in the 1990's with multi-GeV electrons; Seillac, France (27 Jun 1988).

A novel laser-driven polarized source of hydrogen and deuterium which operates on the principle of spin exchange optical pumping is described. The advantages of this method over conventional polarized sources for internal target experiments are presented. Technological difficulties which prevent ideal source operation are outlined along with proposed solutions. At present, the laser-driven polarized hydrogen source delivers 8 {times} 10^{16} atoms/s with a polarization (P/sub z/) of 24%. 9 refs., 2 figs.

56367 (INIS-mf—11311, pp 14-15) **Estimation of errors of point kernel integration due to simplifying model assumption for dose buildup factor application.** Pickschneider, J.; Gerullis, W. (VEB Bergmann Borsig, Berlin (German Democratic Republic). Stammbetrieb des KKAB). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

56368 (ORNL/TM—10949) **Advanced Neutron Source (ANS) regulatory requirements and safety-related considerations: August 1988 Draft.** Harrington, R.M.; Flanagan, C.A. (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 63p. NTIS, PC A04/MF A01. Order Number DE89001150/JAW.

The purpose of this document is to outline the safety-related considerations for Advanced Neutron Source (ANS) and, by so doing, to indicate the regulatory requirements and design considerations that must be addressed by the project in the design and during subsequent operations. As such, this document represents a road map of how the project intends to analyze and document nuclear safety concerns and design considerations that will have to be addressed by the ANS Project. As the project matures and the design becomes better defined and projected performance better understood, the safety-related considerations will also become better defined and interpreted. Appropriate safety-related analyses and documentation will be produced (e.g., preliminary and final safety analysis reports). This document summarizes the sources of applicable regulatory requirements, indicates recent policy guidance from the NRC, provides the NRC general design criteria that must be met, suggests which of the major ANS systems components are likely to be categorized as "safety related," and provides descriptive material that is of safety interest and importance.

56369 (UCRL—98946) **RTNS-II [Rotating Target Neutron Source II] operational summary.** Heikkinen, D.W. (Lawrence Livermore National Lab., CA (USA)). Sep 1988. Contract W-7405-ENG-48. 13p. (CONF-881151—13). NTIS, PC A03/MF A01. Order Number DE89001126/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

The Rotating Target Neutron Source II facility (RTNS-II) operated for over nine years. Its purpose was to provide high intensities of 14 MeV neutrons for materials studies in the fusion energy program. For the period from 1982-1987, the facility was supported by both the US (Department of Energy) and Japan (Ministry of Education, Culture, and Science). RTNS-II contains two accelerator-based neutron sources which use the T(d,n)^{4}He reaction. In this paper, we will summarize the operational history of RTNS-II. Typical operating parameters are given. In addition, a brief description of the experimental program is presented. The current status and future options for the facility are discussed. 7 refs., 5 tabs.

08 HYDROGEN

56370 (OH—8109) Hydrogen, a challenging opportunity. Synopsis, a summary report of the Ontario Hydrogen Energy Task Force. (Ontario Hydro, Toronto (Canada)). Sep 1981. 12p. (CE—01897). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report summarizes the overall work of a task force charged with investigating the roles of hydrogen as a new energy source in the Ontario economy. The report outlines the basics of hydrogen supply, distribution, and storage, uses of hydrogen, and a hydrogen implementation strategy. The primary source of hydrogen is seen to be from electrolysis of water, given Ontario's abundance of electric power; the total possible market for electrolytic hydrogen in Ontario is identified as about 257 petajoules by the year 2000, or about 10% of the primary energy currently obtained from outside the province. A market penetration of one sixth of this figure is indicated as a target which could be met with government support. Potential applications include displacement of hydrogen currently obtained from steam methane reformers in refineries, in methanol production, and in transportation. The overall conclusion was that non-fossil-derived hydrogen, based on indigenous Ontario resources, has the potential to displace fuels derived from crude oil in the transportation sector, although this is not anticipated to occur before the mid 1990s. Recommendations are made on the future development of the hydrogen energy concept and its implementation. 2 tabs.

0801 Production

56371 (PB—88-240031/XAB) Vectorial electron transfer on designed surfaces. Annual report, February 1987-January 1988. Bard, A.J.; Campion, A.; Fox, M.A.; Mallouk, T.E.; Webber, S.E. (Texas Univ., Austin (USA). Dept. of Chemistry). 1988. 80p. NTIS, PC A05/MF A01.

See also annual report dated 1987, PB—87-232229.

Silica-supported WS_2 and Ni-doped WS_2 were found to be good catalysts for the reduction of water to hydrogen. In systems employing CdS/SiO_2 sensitizer particles, WS_2/SiO_2 was more active and stable for hydrogen generation than Pt/SiO_2. n-TiO_2 and n-$SiTiO_3$ were sensitized by adsorbed dyes ruthenium(II)tris(2,2'-bipyridine-4,4'-dicarboxylic acid and zinc tetrakis(4-carboxyphenyl)porphyrin; quantum efficiencies for sensitization were 10-60% and were maximized at monolayer dye coverage. II-VI semiconductors particles (ZnS, ZnSe, CdS, CdSe) were produced in Nafion membranes and in Langmuir-Blodgett multilayer films by exposure of the M(2+)-containing matrix to gaseous H_2S or H_2Se. Quantum-size effects are manifested in the optical spectra of these particles, the absorbance onset being blueshifted by approximately 0.4eV. A method was developed for photopolymerization of polypyrrole on TiO_2 and CdS particles. The polypyrrole layer binds fluorescein anions which sensitize the semiconductor for photocatalytic hydrogen evolution, and the polymer inhibits photocorrosion of CdS. Cu electrodes used in the electrochemical reduction of CO_2 to CH_4 were examined by XPS and Auger spectroscopy; no evidence is seen for Cu(I) and Cu(II) carbidic species as intermediates in the reduction. Alkoxyl groups are identified as possible intermediates.

0802 Storage

56372 (NRC/E—NRC23336) Hydrogen and energy storage. Alderson, J.E.A.; Hammerli, M.; Murphy, J.R.B.; Taylor, J.B. (National Research Council of Canada, Ottawa, Ontario. Div. of Energy). Apr 1984. 134p. (CE—01909). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The Hydrogen and Energy Storage (H&ES) program directs research and development activities in this area in Canada, and this report summarizes those activities in a number of program areas. These include: hydrogen production by electrolysis and thermochemical methods; technology for hydrogen production, including electrodes, separators, electrolytes, and other materials research; hydrogen storage, both in a large and small scale, by pressure vessels, microencapsulation, hydrides and other means; liquid hydrogen carriers; safety and embrittlement studies; fuel cells; hydrogen-fuelled engines and subsystems; and energy storage by electrochemical, mechanical, and thermal methods. Specific contracts are also described in these categories, and a list of publications and presentations resulting from this research is appended. 144 refs., 11 figs.

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 56014, 56439, 56440

56373 (BCR—83) Chemicals from forest products by supercritical gas extraction. Phase 3. McDonald, E.C.; Howard, J.; Bennett, B. (B.C. Research, Vancouver (Canada)). [1983]. 123p. (CE—01934). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Supercritical gas extraction of green sawdusts resulted in liquid products. Yields of extract were over 70% when acetone or methanol at 350/sup0/C and 28 megapascals were used. Similar yields could be obtained at lower extraction temperatures and pressures when the wood was pretreated with acid. Extracts obtained using acetone and methanol were examined for chemical composition and also evaluated as substitutes for phenol in phenol-formaldehyde adhesives. Analyses for elements, calorific value and methoxyl content were performed. Levoglucosan and substituted guaiacols were identified in the complex products. Up to 30% of the phenol in phenolic resins could be substituted by acetone extract for waferboard adhesives. The chemical composition of the extraction products indicates that they would not be directly marketable as liquid fuels. Further processing would be required to obtain marketable commodities. An economic analysis indicated that product cost would be $42 a barrel for an 800 bbl/d plant, excluding land and wood costs. Resin and fatty acids were recovered from pine using supercritical CO/sub 2/, nitrous oxide, propane or ethylene. Yields were higher when propane or nitrous oxide was used. Higher pressures resulted in higher yields. Similar yield differences were observed when waxes were extracted from Douglas fir bark. The yields of chemicals by supercritical gas extraction were equal to or greater than those by solvent extraction. Supercritical gas extraction gave products which would be marketable directly. The application of this technique could reduce the use of petroleum-based solvents for the isolation of chemicals from forest products. 18 refs., 31 figs., 25 tabs.

56374 (DOE/PC/70032—T2) Diffusivities of synthesis gas and Fischer--Tropsch products in slurry media: Final report. Akgerman, A. (Texas A and M Univ., College Station (USA). Dept. of Chemical Engineering). [1987]. Contract AC22-84PC70032. 108p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88013683/JAW.

The task of estimating diffusion coefficients in a Fischer--Tropsch reactor is by no means elementary. The steady state liquid phase, often referred to as FT wax, is primarily a mixture of saturated hydrocarbons with an average carbon number of about 30, although it can range as high as 70. The melting point of the FT wax is typically in excess of 100{degree}C, and reaction conditions of the normal process range from 473{endash}573 K at 1 to 5 MPa. Prior to this study, diffusion coefficients in even the simplest pure low melting hydrocarbons had not been measured at these conditions. The diffusion coefficients measured in this study are properly referred to an {open←quote}mutual diffusion coefficients at infinite dilution{close←quote}. The mutual diffusion coefficient, D_{12}, is the most common type of diffusion coefficient and is the diffusion coefficient required for mass transfer calculations. Often the mutual diffusion coefficient is simply referred to as the diffusivity of solute A in solvent B. Since most gases are only sparingly soluble in liquids, mutual diffusion coefficients for gases in liquids are always reported

as being an infinite dilution. Since liquid--liquid mixtures can exist over the entire concentration range, the effect of concentration on the liquid--liquid mutual diffusion coefficient can sometimes be important. However, for the case of diffusion in Fischer--Tropsch wax, the mutual diffusion coefficient at infinite dilution, D_{12}^0, is the proper diffusion coefficient for design calculations. In this case, D_{12}^0, represents the diffusion of infinitely dilute solute, 1, through the Fischer--Tropsch war mixture, 2. This is precisely the situation occurring as a product or reactant diffuses to or form the surface of the FT catalyst. 79 refs.

56375 **(PB—88-240841/XAB) Kinetics of chemisorption and gasification reactions of carbon for evaluation of the role of electron-transfer processes. Final report, January 1986-December 1987.** DeGroot, W.F.; Richards, G.N. (Montana Univ., Missoula (USA). Wood Chemistry Lab.). 21 Jun 1988. 103p. NTIS, PC A06/MF A01.

See also PB—87-181970.

Rates of gasification of a cellulose char prepared at 1000 C were measured at several temperatures in 0.1 atm of O_2, CO_2, NO and H_2O. Due to decomposition of the reactant gas at high temperatures, the rate of gasification in N_2O could only be determined at a single temperature, 600 C. The research represents the first comprehensive study of relative rates of reactions of different gases using a single well-defined carbon. Gasification was carried out in a miniature reactor designed to provide precise control of reaction conditions. The results of the study, along with existing data for other types of carbon, will allow more-meaningful comparison of relative rate data to fundamental chemical parameters of the reactant gases as a means of deducing the specific chemical steps that control the rates of gasification reactions.

56376 **Process for converting light alkanes to higher hydrocarbons.** Noceti, R.P.; Taylor, C.E. US Patent Application 6-045,634. 4 Mar 1987. 24p. NTIS, PC A03/MF A01.

A process is disclosed for the production of aromatic-rich, gasoline boiling range hydrocarbons from the lower alkanes, particularly from methane. The process is carried out in two stages. In the first, alkane is treated with oxygen and hydrogen chloride over an oxyhydrochlorination catalyst such as copper chloride with minor proportions of potassium chloride and rare earth chloride. This produces an intermediate gaseous mixture containing water and contacted with a crystalline aluminosilicate catalyst in the hydrogen or metal promoted form to produce gasoline range hydrocarbons with a high proportion of aromatics and a small percentage of light hydrocarbons (C_2-C_4). The light hydrocarbons can be recycled for further processing over the oxyhydrochlorination catalyst. 3 figs.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 56459

56377 **(AC/R—I-65) Alcohol fuels from agriculture - a discussion paper.** Timbers, G.E. (Agriculture Canada, Ottawa, Ontario. Research Branch). Jan 1980. 85p. (CE—01898). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This paper reviews the resource availability, technology, economics, uses, and other considerations regarding alcohol fuels from Canadian agriculture. Resources for alcohol production include sugar and starch crops, and residues from the agriculture and food industries. Technology to produce fermentable sugars by hydrolysis is fairly simple and should be adaptable on a small scale. Recent improvements in pretreatment technology and hydrolytic enzyme systems have all but solved the problem of producing such sugars from Canadian crop and forest residues. Also, some of the restraints on rapid ethanol fermentation are now being removed. New techniques of simultaneous hydrolysis and fermentation are being explored, and energy efficient distillation methods have been developed. At present, to use crop residues for alcohol production requires large capital investment and technology which has not been demonstrated at a commercial scale in Canada. Possible ways around this problem include industrial scale alcohol production, requiring an extensive land base and distribution system; sale or use of byproducts to improve economic feasibility; and use of integrated energy supply systems whereby processing of residues could supply some of the process energy needs. Conversion of crops and residues to ethanol allows very inconvenient solid fuels to be made into useful, mobile fuels, and the use of alcohol in gasoline blends is evaluated. For large-scale alcohol fuel programs to be implemented, problems need to be addressed, such as financing, market demand, and legal aspects. Includes glossary. 47 refs., 6 figs., 9 tabs.

56378 **(STF—21A88015) Fuel grade methanol.** Andersen, M.S. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Feb 1988. 10p. (In Norwegian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88754905/JAW.

The report concerns the production of fuel grade methanol based on the methanol process of Onsager. The production capacity of the plant is designed to be 2500 tons of fuel grade methanol per 24 hours. 3 drawings.

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 56444

56379 **(CONF-880518—5) Effects of feedstock components on municipal solid waste pyrolysis.** Mallya, N.; Helt, J.E. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 17p. NTIS, PC A03/MF A01. Order Number DE89000621/JAW.

From International conference on research in thermochemical biomass conversion; Phoenix, AZ, USA (2 May 1988).

Experimental pyrolysis studies using mixtures of municipal solid waste (MSW) components and refuse-derived fuel (RDF) pellets are reported. The objective of the work is to develop a scientific data base that will support the development of economic engineering processes for the thermochemical conversion of MSW into clean gaseous and liquid fuels. The liquid reaction products have been studied by Fourier transform infrared spectrometry. Physical and chemical properties (e.g., viscosity, calorific value, acid group concentrations, and elemental analyses) have also been obtained for the liquids produced. Discussion is provided on the overall chemical mechanism associated with the pyrolytic decomposition. 10 refs., 6 figs., 4 tabs.

56380 **(DOE/BP/18508—2) Estimating carbon monoxide air quality impacts from woodstoves: Task A: Final report.** Houck, J.E.; Simons, C.A.; Pritchett, L.C. (OMNI Environmental Services, Inc., Beaverton, OR (USA)). Sep 1988. Contract AC79-85BP18508. 142p. NTIS, PC A07. Order Number DE89001548/JAW.

This task report presents a methodology for the identification of suspected carbon monoxide (CO) air quality impacts from the use of woodstoves. A testing methodology was developed from reviewing wintertime CO, fine particulate, heating degree days and wood use data from Northwestern cities. The methodology was evaluated at residential sites in six Northwestern cities: Boise, Idaho; Eugene, Oregon; Libby and Missoula, Montana; Portland, Oregon; and Yakima, Washington. Upper-limit estimates of CO originating from residential wood combustion (RWC) were made at the six sites. In addition to developing and evaluating this primary testing methodology, the role of temporal patterns, chemical mass balance (CMB) modeling, and Carbon-14 in the identification of suspected CO air quality problems from the use of woodstoves was also investigated, and the results are presented in the report. 62 refs., 49 figs., 11 tabs.

56381 **(DOE/BP/18508—3) Estimating the volume of residential wood burning in the Pacific Northwest and Alaska: Task C: Final report.** Greene, W.T.; Simons, C.A. (Bonneville Power Administration, Portland, OR (USA); OMNI Environmental Services, Inc., Beaverton, OR (USA)). Sep 1988. Contract AC79-85BP18508. 64p. NTIS, PC A04/MF A01. Order Number DE89001547/JAW.

This task report characterizes residential wood usage in the Pacific Northwest in the report on available estimates of residential

wood usage by each of five Pacific Northwest states (Alaska, Idaho, Montana, Oregon, and Washington); best estimates of residential wood usage for those states; projecting of future residential wood usage in the Pacific Northwest region; and discussion of factors influencing wood usage levels. 36 refs., 2 figs., 18 tabs.

56382 **(DOE/BP/18508—4) Identification of factors which affect combustion efficiency and environmental impacts from woodstoves: Task D: Final report.** Burnet, P.G.; Simons, C.A. (OMNI Environmental Services, Inc., Beaverton, OR (USA)). Jul 1988. Contract AC79-85BP18508. 121p. NTIS, PC A06. Order Number DE89001550/JAW.

The purpose of this task report is to document the nature and magnitude of factors which affect pollutant emission rates from residential woodstoves. Four areas of investigation for improving woodstove performance are covered under this task: Step 1--pellet-fueled stoves; Step 2--catalytic retrofit devices; Step 3--stove and fuel load size effects; and Step 4--in situ field testing of stove performance. Steps 1 and 2 address innovative technologies which may be used to reduce pollutant emissions from woodstoves. Pellet-fueled stoves and catalytic add-on devices were evaluated in a laboratory environment to document efficiency and emissions. Step 3 investigated factors for reducing emissions from conventional stove technologies. These factors included stove size and fuel load testing in the laboratory. Field testing was conducted in Step 4 to document "real world" stove operation and to assess particulate emissions from woodstoves during such operation. Testing for Task D was completed in March 1986 and results submitted as a draft report in December 1986. 12 figs., 6 tabs.

56383 **(DOE/BP/18508—5) Mitigation measures for minimizing environmental impacts from residential wood combustion: Task E, Final report.** Greene, W.T.; Simons, C.A.; Houck, J.E. (OMNI Environmental Services, Inc., Beaverton, OR (USA)). Sep 1988. Contract AC79-85BP18508. 48p. NTIS, PC A04/MF A01. Order Number DE89001537/JAW.

This task evaluated several categories of mitigation measures that could be used to minimize adverse environmental impacts from residential woodburning. The four environmental issues evaluated in this report are: residential woodsmoke pollution control strategies to reduce ambient air quality impacts; indoor air pollution issues; safety issues; and wood ash disposal issues. The findings with regard to those areas are summarized. 30 refs., 14 tabs.

56384 **(DOE/BP/18508—6) Woodstove emission sampling methods comparability analysis and in-situ evaluation of new technology woodstoves: Task G: Final report.** Simons, C.A.; Christiansen, P.D.; Houck, J.E.; Pritchett, L.C. (OMNI Environmental Services, Inc., Beaverton, OR (USA)). Jun 1988. Contract AC79-85BP18508. 154p. NTIS, PC A08/MF A01. Order Number DE89001551/JAW.

One major objective of this study was to compare several woodstove particulate emission sampling methods under laboratory and in-situ conditions. The laboratory work compared the EPA Method 5H, EPA Method 5G, and OMNI Automated Woodstove Emission Sampler (AWES)/Data LOG'r particulate emission sampling systems. A second major objective of the study was to evaluate the performance of two integral catalytic, two low emission non-catalytic, and two conventional technology woodstoves under in-situ conditions with AWES/Data LOG'r system. The AWES/Data LOG'r and EPA Method 5G sampling systems were also compared in an in-situ test on one of the integral catalytic woodstove models. 7 figs., 12 tabs.

56385 **(DOE/BP/18508—7) Cost/benefit analysis of mitigation measures for minimizing environmental impacts of residential wood combustion: Task F, Final report.** Greene, W.T. (OMNI Environmental Services, Inc., Beaverton, OR (USA)). Jun 1988. Contract AC79-85BP18508. 36p. NTIS, PC A03/MF A01. Order Number DE89001553/JAW.

This task evaluates the costs and benefits associated with effective residential wood smoke control strategies. Annualized costs and benefits for each of the eight effective control strategies identified in Task E are presented. An estimate of annual net benefits is presented for the area covering Alaska, Idaho, Montana, Oregon and Washington states. This investigation covers available information for the following cost or benefit categories: air pollution effects on health, soiling, and visibility; safety issues, including creosote effects and effects on frequency of chimney cleaning; equipment costs; regulatory costs; and energy efficiency effects. There are many large uncertainties associated with the estimates presented in this report. The data presented should be considered to be estimates which can be used to aid decision-making, but should not be relied upon as exact or precise. Section 2 reviews the available cost benefit information. Section 3 applies the cost and benefit factors identified to eight specific residential wood smoke control strategies. Section 4 present conclusions and summarizes the cost and benefit findings. 22 refs., 1 fig., 12 tabs.

56386 **(FCC—P-256) Determination of available heat of combustion data for Canadian woody species.** Kryla, J.M. (Forintek Canada Corp., Ottawa, Ontario). Feb 1984. 94p. (CE—01912). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A literature review was conducted to obtain reliable, experimentally determined calorific data for the various components of Canadian tree species. Information was obtained for 48 tree species native to Canada and is presented in tabular form. For indigenous species, the overall mean calorific value was found to be 21.18 MJ/kg for softwood materials (e.g. stem wood, stem bark, foliage) compared to 19.35 MJ/kg for hardwoods. Variation between reported values for a component of a particular species was found to be generally less than 5% but, in some instances, exceeded 10%. Calorific data are also presented for hybrid poplar and for several foreign species commonly planted in Canada. It is recommended that experimental research be conducted to form a complete calorific value checklist which could be used to supplement Canadian biomass inventory data. 84 refs., 54 tabs.

56387 (SESC—8806, pp 119-126) **Utilization of grain wastes as a supplemental boiler fuel. Description of a demonstration test burn at Thunder Bay GS.** Quick, R. (Ontario Hydro, Toronto). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

In the spring of 1987, the staff at Thunder Bay Generating Station was approached by local grain elevator operators to determine whether Ontario Hydro could help them find a solution for the disposal of grain wastes produced from their operations. The elevator operators' proposal was to investigate the possibility of obtaining energy from waste by burning the grain wastes in one of the power plant's boilers. The rationale to pursue the concept of co-combusting grain wastes with regular station fuel is the fuel savings that may be possible. With a heating value of about 14.9 MJ/kg, one tonne (1 Mg) of grain wastes could displace 0.94 tonne of lignite with a heating value of 15.9 MJ/kg, which is normally fired in two of the power plant's units. As an example, if 40,000 Mg of grain wastes could be burned annually, this would displace approximately 37,600 Mg of lignite. Grain wastes, with a true cost (i.e. cost of trucking from grain elevators to the station) of about $10/Mg would be displacing lignite at a cost ranging form $33-$39/Mg, resulting in a projected annual benefit ranging from approximately $840,000 to $1.1 million. This paper describes the activities undertaken to date to investigate the potential use of this novel product as a supplemental fuel for the power plant. 2 refs., 5 figs.

56388 **(STF—15A87045) Firing with processed fuel in central heating plants.** Rosvold, H. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Feb 1987. 15p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754895/JAW.

The report discusses the firing with processed fuels in central heating plants, and focuses on the ash and slag produced by the combustion of processed biomass fuels. The analyses done in this project, concerns both the raw materials to be used in pellet production and pelletized fuels for incinerators. Slagging is studied under various combustion and operation conditions for pellets. The

results show that there are to be clear interactions between the fuel qualities, operation conditions, and slagging. 1 table.

13 HYDRO ENERGY

56389 (HQ—1988) Catalog of publications of Hydro-Quebec, 1987-88. (Hydro-Quebec, Montreal (Canada)). 1988. 15p. (In French). (MICROLOG—88-03963). Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, P.Q., Canada H2Z 1A4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This catalog contains a list of over 100 Hydro-Quebec publications in the fields of electricity utilization, power plants, power transmission, environment, telecommunications and network management, scientific and technical information, finances and administration, language and terminology, and safety. Items are designated by level of interest, from primary school to specialist. Includes title index.

56390 (HQ—1988) Catalog of audiovisual documents of Hydro-Quebec, 1987-88. (Hydro-Quebec, Montreal (Canada)). 1988. 42p. (In French). (MICROLOG—88-03962). Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, P.Q., Canada H2Z 1A4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

For making various aspects of energy better known, Hydro-Quebec makes available audiovisual materials listed in this catalog. They are intended for loan to groups, associations, institutions, and organizations, as well as to different administrative units of Hydro-Quebec itself. Over 100 titles are included, under the areas of: utilization of electricity; water resources and hydroelectric installations; power plants; power transmission; telecommunications and network management; scientific and technical aspects; environment; safety; finance and administration; and energy and development. Materials are in the form of film, videotape, or slides, and an interest level is indicated for each item (from primary school level to specialist level). Includes title index.

1301 Resources And Availability

56391 (AD-A—194985/8/XAB) Genesee River Basin study. Volume 1. Main report. Final feasibility report. (Corps of Engineers, Buffalo, NY (USA). Buffalo District). Jun 1988. 131p. NTIS, PC A07/MF A01.

This feasibility report discusses plans considered under the Genesee River Basin Study Authority. Two of these plans--a multi-use reservoir at Stannards and modification to the existing Mt. Morris Dam and reservoir for multi-use including flood control, recreation, hydropower, and irrigation--were found not economically feasible for single-purpose flood control. The Federal Government, therefore, recommended no further Federal actions.

56392 (SESC—8806, pp 85-87) **Remote small hydro installations.** Schwartz, F.H. (Powerx, Toronto, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

This paper reviews the potential of remote small hydro installations in Canada. Two types of sites are envisioned; those adjacent to Canada's over 300 remote communities, and those close enough to existing transmission lines to make installation economically feasible. Experience has been gained in British Columbia, Quebec, Ontario and Newfoundland/Laborador, where remote community, tourist lodge and other commercial, and park facilities have been installed. Jurisdictions involved in these power developments include the provincial and federal approval agencies, the utilities, Indian and Northern Affairs Canada and the communities. Utility policies vary across the country with respect to their willingness and methods of dealing with purchase of power from small power producers. Rates paid for power vary from utility to utility. Remote installations carry with them unique circumstances which must be dealt with in order to successfully complete a project. These are in the areas of engineering and technology, transportation logistics and scheduling, financing, availability of materials and equipment, and sensitivity towards local inhabitants.

1303 Plant Design And Operation

REFER ALSO TO CITATION(S) 58309

56393 (CREIC—8601, pp 8) **Small hydro technology overviews.** Bates, B.H. (Galt Energy Systems Ltd., Cambridge, Ont.). 1986. CANMET; $0.34CAN per page, $3.40 CAN minimum. (CONF-860124—; CE—01913).

From New energy sources: challenges and business opportunities; Toronto, Ontario, Canada (26 Jan 1986).

This paper outlines the basics of small hydro power in Ontario (under 10,000 KW) and the experiences of an Ontario company in small hydro development. Some specific projects are described, including an installation at an old Ontario Hydro decommissioned site and an inverted syphon system where the turbine is mounted at the head pond level. Cost effectiveness of small hydro development is examined, and the payback period for viable development is suggested to be 7-8 years for the private sector (12-13 years for a utility). Operating costs are briefly mentioned. The developing of economically viable small hydro sites is felt to be dependent on a sufficiently high buyback rate structure at the local utility; a rate of 4-5 cents per kWh is concluded to be justifiable. Other barriers to small hydro development include complexity of regulatory approval and difficulty of financing. Benefits of small hydro development include a lowering of marginal electricity cost, job creation, low environmental impact, predictability of energy supply and cost, short lead times for implementation, and ability to replace costly diesel generators in remote areas.

56394 (SESC—8806, pp 92-95) **The Casselman Small Hydro Project.** Bennett, K.J. (Ottawa Engineering Limited, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

The Casselman Small Hydro Project is a 375 kW private hydropower development located on the South Nation River at Casselman, Ontario. The project was completed in the summer of 1987. All the power generated is sold to Ontario Hydro. The project is owned by a local entrepreneur who played a major role in all phases of the development, from inception through design and construction. It is clear that without the cost savings realized due to owner involvement, the project would not have been economically feasible. The final cost was about $635,000, or $1,700 per installed kW. This paper provides gives an overview of the project and summarizes the experience gained. 1 fig.

1304 Regulations And Licensing

56395 (EPRI-AP—6038-Vol.1) Guide for developing a hydro plant relicensing strategy: Volume 1, Major issues and R & D needs: Final report. Hunt, R.T. (Electric Power Research Inst., Palo Alto, CA (USA); Hunt (Richard) Associates, Concord, NH (USA)). Oct 1988. 187p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89001085/JAW.

Since the late 1970's, the licensing of hydroelectric power plants has become an increasingly complex, time-consuming, and costly process. In October of 1986, a new law that focused on the relicensing issue exacerbated this situation by completely changing the process and requirements for licensing a hydro project. The law was passed as many utilities that had not been involved in the FERC licensing process in many years were in the planning stages for relicensing their existing older hydro projects. The objective of this study is to provide a guide that will help utilities through the process of relicensing their hydro facilities. The study is organized into two parts. Volume I presents a synopsis of the new law and

then discusses the legislative mandates provided in the law, the relicensing issues and concerns raised by the law, the implementation of key provisions of the law by FERC, and the differences between licensing and relicensing. Some research opportunities for EPRI are also suggested. Volume II provides a comprehensive guide for relicensing a hydro project.

1306 Environmental Aspects

REFER ALSO TO CITATION(S) 56427, 56729

56396 (ASPB—8404, pp 49-64) **The Slave River Hydro Project - mitigation planning.** Pearce, G. (Slave River Hydro Project, Alta.). [1988]. Alberta Society of Professional Biologists, P.O. Box 566, Edmonton, Alta., Canada T5J 2K8; $15.00 CAN; MFCANMET/TID, Energy, Mines and Resources, CAN, 555 Booth St., Ottawa, Ont., CAN K1A 0G1; $10 CAN. (CONF-8404344—; MICROLOG—88-00214).

From Symposium on environmental mitigation: solutions to problems; Edmonton, Canada (24 Apr 1984).

This paper describes the Slave River hydroelectric project in northern Alberta and the planning involved in mitigation of possible environmental effects from the project. The 1800 MW installation is a run-of-the-river type of project with no storage capability. A feasibility study was conducted in 1982 which recommended three alternative schemes. In a pre-investment phase, the feasibility study was reviewed by the provincial government and participating utility companies, this review including various environmental studies as well as financial evaluations. Informational requirements were also assessed in a study by Alberta Environment and the Federal Environmental Assessment Review Office. Guidelines for environmental mitigation included recommendations with respect to social impacts such as local employment and business opportunities. The whole process as outlined in this paper is felt to show that there is a commitment to attempt to solve or reduce environmental and socio-economic impacts as they are identified, at a very early stage. The next phase, construction, is not expected before 1989.

56397 (CONF-8608141—4) **White alder growth and development: The effect of small hydroelectric projects in the Sierra Nevada of California.** Doyle, T.W. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01. Order Number DE89000424/JAW.

From Industrial symposium on ecological aspects of tree ring analysis; Tarrytown, NY, USA (17 Aug 1986).

A dendroecological study of white alder, Alnus rhombifolia, growth and development was implemented to evaluate the effect of diverted streamflow on riparian vegetation by small hydroelectric projects in the western Sierra Nevada of California. The study was designed to determine whether white alder trees along dewatered stream reached incurred greater moisture stress and/or growth decline due to streamflow reduction as compared with individuals along unaffected or normal stream reaches. Ring width was measured for every growth year and used in conjunction with diameter readings to calculate yearly basal area increment. Results showed no significant reduction or decline in either radial growth or basal area increment between the pre-diversion (normal) decade and post-diversion (dry) periods. Age group analyses indicated that no significant difference in growth rate existed between the dewatered and unaffected groups of any age class. In most cases, growth rates of trees under dewatered conditions proved slightly greater than their counterparts persisting under normal stream activity. These findings suggest that other factors (i.e., rooting substrate and depth, competition) likely play a greater role in limiting white alder growth than does water availability as dictated by streamflow. 2 refs., 4 tabs.

56398 (DOE/BP/18952—3) **Columbia River white sturgeon genetics and early life history: Population segregation and juvenile feeding behavior: Final report: January 1, 1987 to December 31, 1987.** Brannon, E.; Setter, A.; Altick, J.; Miller, M. (USDOE Bonneville Power Administration, Portland, OR. Div. of Fish and Wildlife; Washington Univ., Seattle (USA). School of Fisheries). Jun 1988. Contract AI79-84BP18952. 88p. NTIS, PC A05/MF A01. Order Number DE89001540/JAW.

The geographic area of the genetics study broadly covered the distribution range of sturgeon in the Columbia from below Bonneville Dam at Ilwaco at Lake Roosevelt, the Upper Snake River, and the Kootenai River. The two remote river sections provided data important for enhancement considerations. There was little electrophoretic variation seen among individuals from the Kootenai River. Upper Snake river sturgeon showed a higher percentage of polymorphic loci than the Kootenai fish, but lower than the other areas in the Columbia River we sampled. Sample size was increased in both Lake Roosevelt and at Electrophoretic variation was specific to an individual sampling area in several cases and this shaped our conclusions. The 1987 early life history studies concentrated on the feeding behavior of juvenile sturgeon. The chemostimulant components in prey attractive to sturgeon were examined, and the sensory systems utilized by foraging sturgeon were determined under different environmental conditions. These results were discussed with regard to the environmental changes that have occurred in the Columbia River. Under present river conditions, the feeding mechanism of sturgeon is more restricted to certain prey types, and their feeding range may be limited. In these situations, enhancement measures cannot be undertaken without consideration given to the introduction of food resources that will be readily available under present conditions. 89 refs., 7 figs., 11 tabs.

56399 (DOE/BP/64341—1, pp 51-110) **Cultural resource overview of the John Day acclimation ponds project.** Welch, J.M. (Western Heritage, Olympia, WA (USA)). Feb 1988. NTIS, PC A 99. Order Number DE88007390/JAW.

In John Day Fall Chinook/Salmon Mitigation Plan acclimation and imprinting site feasibility study: Summary report.

This report was prepared as a part of an engineering feasibility study to determine sites suitable for acclimation and imprinting of bright fall chinook salmon. The purpose of the plan is to replace salmon lost by construction of the John Day Dam on the Columbia River. The report includes geology, prehistory, and ethnography of the White Bluffs Ferry, Ringold, Sunnyside Dam, Prosser, Walla Walla, Hat Rock Pond, Three Mile Canyon and Willow Creek Backwater Sites. The sites are located on the Columbia, Yakima, and Walla Walla River systems. Previous archaeological investigations, pertinent history, conclusions and recommendations are specific to the individual sites. The results of the overview are used as a basis for planning details of specific project areas and to comply with legal requirements to integrate land use planning with resource management.

56400 (DOE/BP/64341—1, pp 163-215) **John Day Fall chinook/salmon mitigation plan acclimation and imprinting site feasibility study Prosser Juvenile Trap Site.** Feb 1988. NTIS, PC A 99. Order Number DE88007390/JAW.

In John Day Fall Chinook/Salmon Mitigation Plan acclimation and imprinting site feasibility study: Summary report.

This report presents results from an engineering feasibility study of the Prosser Site as an acclimation facility for chinook salmon. The study is part of the John Day Falls Chinook Salmon Replacement Mitigation Plan. The Prosser Juvenile Trap is located adjacent to the Yakima River in Benton, Washington and is one of ten sites evaluated for the ability to provide acclimation and imprinting for 30,000 lb of fry or smolts in four 7500 lb lots. The following information is included: site characterization; production goals; development concepts; water quality and temperature studies; cost summary; and advantages or disadvantages of the site.

56401 (DOE/BP/64341—1, pp 216-278) **John Day Fall chinook/salmon mitigation plan acclimation and imprinting site feasibility study White Bluffs Site.** Feb 1988. NTIS, PC A 99. Order Number DE88007390/JAW.

In John Day Fall Chinook/Salmon Mitigation Plan acclimation and imprinting site feasibility study: Summary report.

This report presents results from an engineering feasibility study of the White Bluffs Site as an acclimation facility for chinook salmon. The study is part of the John Day Falls Chinook Salmon Replacement Mitigation Plan. White Bluffs Ferry is on the northeast Columbia River shore in Franklin County, Washington and is one of ten sites evaluated for the ability to provide acclimation and imprinting for 30,000 lb of fry or smolts in four 7500 lb lots. The following information is included: site characterization; production goals; development concepts; water quality and temperature studies; cost summary; and advantages or disadvantages of the site.

56402 (DOE/BP/64341—1, pp 279-345) **John Day Fall chinook/salmon mitigation plan acclimation and imprinting site feasibility study Hat Rock Site.** Feb 1988. NTIS, PC A 99. Order Number DE88007390/JAW.

In John Day Fall Chinook/Salmon Mitigation Plan acclimation and imprinting site feasibility study: Summary report.

This report presents results from an engineering feasibility study of the Hat Rock Site as an acclimation facility for chinook salmon. The study is part of the John Day Falls Chinook Salmon Replacement Mitigation Plan. Hat Rock is part of the Oregon Hat Rock State Park on the Columbia River and is one of ten sites evaluated for the ability to provide acclimation and imprinting for 30,000 lb of fry or smolts in four 7500 lb lots. The following information is included: site characterization; production goals; development concepts; water quality and temperature studies; cost summary; and advantages or disadvantages of the site.

56403 (DOE/BP/64341—1, pp 346-398) **John Day Fall Chinook/Salmon Mitigation Plan acclimation and imprinting site feasibility study Ringold Springs Site.** Feb 1988. NTIS, PC A 99. Order Number DE88007390/JAW.

In John Day Fall Chinook/Salmon Mitigation Plan acclimation and imprinting site feasibility study: Summary report.

This report presents results from an engineering feasibility study of the Ringold Springs Site as an acclimation facility for chinook salmon. The study is part of the John Day Falls Chinook Salmon Replacement Mitigation Plan. Ringold Springs is located adjacent to the Columbia River in Franklin County, Washington and is one of ten sites evaluated for the ability to provide acclimation and imprinting for 30,000 lb of fry or smolts in four 7500 lb lots. The following information is included: site characterization; production goals; development concepts; water quality and temperature studies; cost summary; and advantages or disadvantages of the site.

56404 (DOE/BP/64341—1, pp 482-561) **John Day Fall Chinook/Salmon Mitigation Plan acclimation and imprinting site feasibility study Walla Walla Site.** Feb 1988. NTIS, PC A 99. Order Number DE88007390/JAW.

In John Day Fall Chinook/Salmon Mitigation Plan acclimation and imprinting site feasibility study: Summary report.

This report presents results from an engineering feasibility study of the Walla Walla Site as an acclimation facility for chinook salmon. The study is part of the John Day Falls Chinook Salmon Replacement Mitigation Plan. The Walla Walla site is on a privately owned farm near Lowden, Washington and is one of ten sites evaluated for the ability to provide acclimation and imprinting for 30,000 lb of fry or smolts in four 7500 lb lots. The following information is included: site characterization; production goals; development concepts; water quality and temperature studies; cost summary; and advantages or disadvantages of the site.

56405 (EPRI-CS/EA/AP—5663-SR, pp 1.1-1.11) **Comparative assessment of fish protection alternatives for fossil and hydroelectric facilities.** Taft, E.P.; Downing, J.K. (Stone & Webster Engineering Corp., Boston, MA (USA)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920262/JAW. (CONF-8710303—).

From Fish protection at steam and hydroelectric power plants; San Francisco, CA, USA (28 Oct 1987).

Historically, there have been both similarities and differences in the approach taken to developing fish protection systems for fossil and hydroelectric facilities. Differences have been primarily in the types of systems studied. The greatest similarity has been the tendency to apply systems at sites where the need for fish protection has not been firmly established and the data needed to determine the potential biological effectiveness of a given system is largely lacking. As a result, protection systems have been applied where they may not be needed and they may not be effective. Current research is directed at optimizing the performance of new or existing protection systems. The need to develop effective systems for hydroelectric facilities is critical due to the large number of projects to be licensed presently and in the near future. The present approach taken to selecting appropriate fish protection measures for a project needs revision to prevent the misapplication of systems that occurred in the past.

56406 (EPRI-CS/EA/AP—5663-SR, pp 1.12-1.23) **Fish collection, transportation and release in relation to protection at power plants.** Eicher, G.J. (Eicher Associates, Incorporated, Portland, OR (USA)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920262/JAW. (CONF-8710303—).

From Fish protection at steam and hydroelectric power plants; San Francisco, CA, USA (28 Oct 1987).

Protection of fish at thermal and hydroelectric power plants requires systems to collect or divert fish and move them through or past the project, then release them safely in downstream waters. A variety of concepts are available for these systems. Thermal plants usually involve short distances but frequently encounter problems of lack of head for gravity flows. At hydroelectric plants, collections may be made upstream of or in a reservoir or after diversion from turbine routes by various methods. Or the turbines themselves may provide collection, route of travel and release systems. Unique systems are described for overcoming problems in head differences and unusual circumstances. Method of counting and releasing fish safely are described.

56407 (EPRI-CS/EA/AP—5663-SR, pp 1.24-1.40) **New methodology for fish survival experiments based on release-recapture.** Burnham, K.P.; Anderson, D.R.; White, G.C. (North Carolina State Univ., Raleigh (USA)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920262/JAW. (CONF-8710303—).

From Fish protection at steam and hydroelectric power plants; San Francisco, CA, USA (28 Oct 1987).

A summary of new statistical theory is presented for the analysis of survival experiments that use recapture or resighting data collected after the release of marked individuals. Experiments consist of at least one treatment and one control groups, with the purpose of comparing survival across treatment levels.

56408 (EPRI-CS/EA/AP—5663-SR, pp 1.41-1.54) **Juvenile salmonid bypass research at Bonneville Second Powerhouse, Columbia River.** Williams, J.G.; Gessel, M.H.; Chambers, D.R. (National Marine Fisheries Service, Seattle, WA (USA)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920262/JAW. (CONF-8710303—).

From Fish protection at steam and hydroelectric power plants; San Francisco, CA, USA (28 Oct 1987).

A research program was conducted between 1984 and 1987 at the Bonneville Second Powerhouse (Bonneville II), Columbia River, to determine the probable causes for the low fish guidance efficiency (FGE) by the juvenile bypass system (JBS). Bonneville II was completed in 1982 and was considered to have a state-of-the-art JBS; however, initial evaluations indicated low FGEs of approximately 20% for yearling and subyearling chinook salmon (Oncorhynchus tshawytscha). Approximately $6 million was spent through the end of Fiscal Year 1987 to develop solutions to improve the situation. In 1987, yearling chinook salmon FGEs were improved to 70% in the research test unit by streamlining the trash racks, lowering the submersible traveling screens (STSs), and modifying the configuration of the upstream face of the project; however, no benefits were found for subyearling chinook salmon. Results from successful tests were not an assurance that a solution was found. The implementation of a viable long-term modification to the project based upon prototype equipment remains to be done.

56409 (EPRI-CS/EA/AP—5663-SR, pp 1.55-1.69) **Salmonid smolt bypass system at Wells Dam on the Columbia River.** Erho, M.W.; Johnson, G.E.; Sullivan, C.M. (Douglas County PUD, East Wenatchee, WA (USA)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920262/JAW. (CONF-8710303—).

From Fish protection at steam and hydroelectric power plants; San Francisco, CA, USA (28 Oct 1987).

Douglas County PUD is developing a bypass system to divert downstream migrant salmonids away from hydroelectric turbine intakes at Wells Dam on the Columbia River. The bypass system uses Wells' hydrocombine design where the spill bay intakes are directly above the turbine intakes. Baffles installed in spill intakes increase forebay flow velocities which attract smolts. Once entrained in the attractant flow, smolts enter the bypass and migrate through the dam in bypass flow instead of turbine flow. In annual studies since 1980, the authors used hydroacoustic and fyke net methods to design and to demonstrate that it is a viable long-term solution for diverting smolts around turbines at Wells Dam.

56410 (EPRI-CS/EA/AP—5663-SR, pp 1.70-1.84) **Hydroacoustic evaluation of deep and shallow spill as a bypass mechanism for downstream migrating salmon and steelhead at Rock Island Dam.** Ransom, B.H.; Raemhild, G.A.; Steig, T.W. (Biosonics, Inc., Seattle, WA (USA)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920262/JAW. (CONF-8710303—).

From Fish protection at steam and hydroelectric power plants; San Francisco, CA, USA (28 Oct 1987).

Hydroacoustic data were collected on downstream migrating juvenile salmon and steelhead during the springs of 1983 and 1984 at Rock Island Dam on the Columbia River. The objective of the studies was to estimate the effectiveness of spill in passing downstream migrants. Water was spilled from the surface, but three spill bays nearest the powerhouse opened deeper than the others. Both deep and shallow spill bays were used in 1983, and only shallow bays were used in 1984. During 1983, the relationship between the proportion of flow spilled and the proportion of fish passed through spill was curvilinear, with increasing spill levels passing proportionately more downstream migrants. Shallow spill bays alone appeared to be nearly as effective at passing downstream migrants as did a combination of deep and shallow bays. During 1984, the use of shallow spill bays for the lower spill levels significantly increased the effectiveness of spill in passing fish. The best fit regression between percentage of fish passing in spill and the percentage of flow spilled was linear. Under the resulting relationship, a 20% spill level would be predicted to pass 30% of the fish, and a 40% level predicted to pass 49% of the fish. Downstream migrants were found to be surface-oriented during both 1983 and 1984. Studies at another Columbia River dam has found downstream migrants to be more effectively passed in surface flow.

56411 (EPRI-CS/EA/AP—5663-SR, pp 2.1-2.14) **Low fish guidance with a turbine intake submersible traveling screen due to avoidance behavior: a case study.** Hays, S.G. (Chelan County Public Utility District, Wenatchee, WA (USA)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920262/JAW. (CONF-8710303—).

From Fish protection at steam and hydroelectric power plants; San Francisco, CA, USA (28 Oct 1987).

A submersible traveling screen (STS) at Rocky Reach Dam had fish guidance efficiencies below 10% despite more than 50% of the fish entering the intake above the STS. Computer modeling indicated that flow velocity at the trashrack above the screen and distance from the trashrack at which avoidance behavior was initiated were the critical variables determining guidance efficiency. Guidance was higher at night than during the day. Increased velocity and placement of a bar screen in front of the trashrack increased guidance efficiency at night but reduced daytime guidance. Use of strobe lights did not consistently affect guidance. Turbid water produced higher daytime guidance. Visual detection of the trashrack and bar screen appeared to enable fish to avoid the STS. Avoidance of the trashrack was not observed when the STS was not installed. The underlying cause of avoidance, whether the physical barrier of the trashrack or the STS, remains undetermined.

56412 (EPRI-CS/EA/AP—5663-SR, pp 2.15-2.30) **Hydroelectric monitoring and analysis techniques of submersible traveling screens inside a hydroelectric turbine intake.** Steig, T.W.; Raemhild, G.A. (Biosonics, Inc., Seattle, WA (USA)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920262/JAW. (CONF-8710303—).

From Fish protection at steam and hydroelectric power plants; San Francisco, CA, USA (28 Oct 1987).

The horizontal, vertical, and temporal distributions of downstream migrating juvenile salmonids were hydroacoustically investigated to determine a viable bypass system at Rocky Reach Dam on the Columbia River. The studies have evolved over five years. The original studies were conducted to estimate the horizontal and vertical distribution of migrants at the powerhouse. Subsequent studies evaluated the effectiveness of spilling water as a mechanism for bypassing the juvenile salmonids past turbine units. The latest studies investigated the use of submersible traveling screen (STS) to bypass the juvenile salmonids. The evaluation of the STS necessitated development of new hydroacoustic equipment and data analysis techniques. The confined space within and in front of the turbine intake was sampled with newly developed transducers with elliptical beam patterns. New data analysis techniques were developed to characterize differences in fish distributions, which could be used to assist in the design, installation and operation of the STS. The recent developments in this field have made hydroacoustic monitoring a viable sampling method for difficult and confined sampling areas.

56413 (EPRI-CS/EA/AP—5663-SR, pp 2.31-2.50) **Computer model for fish trajectories at Rocky Beach Dam: indications that fish avoid low frequency sound made by the submersible traveling screen.** Anderson, J.J. (Univ. of Washington, Seattle (USA)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920262/JAW. (CONF-8710303—).

From Fish protection at steam and hydroelectric power plants; San Francisco, CA, USA (28 Oct 1987).

Factors that affect fish guidance efficiency at Rocky Reach Dam were investigated using a computer model to describe the trajectories of fish in terms of movements by water flow and swimming in response to stimuli. Flow parameters were estimated from least-squares regressions on flow observations. Behavioral parameters were estimated by fitting the model to observed fish guidance efficiency and fyke net distributions using a chi-square minimization. The model analysis suggested that without a submersible traveling screen (STS) behind the trashrack, fish readily passed through the trashrack. When a STS was present, fish actively avoided the trashrack in front of the STS. The avoidance response caused fish to move down the face of the trashrack. Below the STS, avoidance decreased and fish passage through the trashrack increased. The small fish guidance efficiency obtained with the STS at Rocky Reach could be accounted for by random flow fluctuations exceeding the fish's escape velocities. The analysis suggested that the STS produced an aversive stimulus that caused active avoidance in the vicinity of the STS. A hypothesis is proposed that the STS generated low frequency sounds that fish avoid.

56414 (EPRI-CS/EA/AP—5663-SR, pp 2.66-2.85) **High reliability considerations for traveling fish screens.** Tsou, J.; Mussalli, Y.G. (Electric Power Research Institute, Palo Alto, CA (USA)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920262/JAW. (CONF-8710303—).

From Fish protection at steam and hydroelectric power plants; San Francisco, CA, USA (28 Oct 1987).

Traveling fish screens experience wear and failures due to continuous or frequent operation that is required for enhanced fish survival. EPRI, under Project RP 1689-9, sponsored the evaluation and monitoring of screens at 16 power plants, in order to develop recommended practices for reliable designs. The improvements include motors and controls, and more durable and corrosion-resistant materials, and proper maintenance.

56415 (EPRI-CS/EA/AP—5663-SR, pp 2.86-2.100) **Redesign of vertically-travelling barrier screens equipped with fish recovery apparatus: flume experiments and field tests.** Fletcher, R.I.; Gathright, T.T.; Marcellus, K.L. (Great Salt Bay Experimental Station, Damariscotta, ME (USA)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920262/JAW. (CONF-8710303—).

From Fish protection at steam and hydroelectric power plants; San Francisco, CA, USA (28 Oct 1987).

The travelling barrier devices known as Ristroph screens are manufactured in a variety of configurations, but all are equipped with fish-catching troughs or rails, and all operate on the principle of direct contact and active removal of impounded fish. The imposed injuries and mortalities associated with these machines are commonly attributed to impingement, but the in situ observations and experiments reported here imply that impingement as such is not the principal agent of mortality it is thought to be. In experiments in the Royce hydrodynamics flume on the various designs of Ristroph screen panels, juvenile fishes survived impingement without significant harm for extended periods at water speeds to 45 cm/s, except for random descaling of tender species by those screens panels fitted with crimped or welded wire mesh. An elongate, smooth-woven mesh employed by one manufacturer imposed no detectable descaling. In the case of screens that travel continuously, the durations of impingements are on the order of minutes, which implies that impingement could not alone account for the high mortalities observed in our field tests on a machine fitted with the smooth-woven mesh. From direct observations in the hydrodynamics flume, the major underwater injuries attributable instead to buffeting of fish within the fish troughs proper.

56416 (EPRI-CS/EA/AP—5663-SR, pp 3.1-3.11) **Arbuckle Mountain hydro vertical-axis fish screens.** Ott, R.F.; Strong, J.J.; Finch, H.E. (Ott Water Engineers, Inc., Redding, CA (USA)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920262/JAW. (CONF-8710303—).

From Fish protection at steam and hydroelectric power plants; San Francisco, CA, USA (28 Oct 1987).

Fish screens to exclude small fry and debris at remote sites such as Arbuckle Mountain Hydroelectric Plant pose unique design considerations to satisfy criteria established by fisheries agencies. Inasmuch as it is desirable to continuously clean the fish screens, a technique had to be devised whereby the controls operate without electricity which was unavailable at the diversion. The cleaning had to be accomplished during flood as well as low flow conditions while continuously providing 115 cubic feet per second (cfs) to the turbine.

56417 (EPRI-CS/EA/AP—5663-SR, pp 3.12-3.22) **Innovative static self-cleaning intake screen protects both aquatic life and turbine equipment.** Ott, R.F.; Boersma, E.; Strong, J.J. (Ott Water Engineers, Inc., Redding, CA (USA)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920262/JAW. (CONF-8710303—).

From Fish protection at steam and hydroelectric power plants; San Francisco, CA, USA (28 Oct 1987).

The successful operation of small hydro projects requires an intake system with the ability to screen fish and debris from the water taken into the turbine. This separation may be required in order to protect stream bio-life and/or to protect the turbine from materials that would wear or clog components. Small intake systems also need to be reliable while requiring a minimum amount of maintenance. An intake screening system which meets these requirements has been developed. The system uses one or more concave screen panels arranged in a linear array. The system is installed along the crest of dams or diversion structures. As the water flows over the crest and down the screens, a portion passes through the screens to the hydropower turbine. The remainder flows across the screen surface carrying aquatic life and debris downstream. Components are fabricated from stainless steel, and are designed for low maintenance free operation. Biolife, pine needles, leaves, and gravel are kept out of the penstock and the turbine. The design of the intake system minimizes the problem of clogging and reduced thruflow.

56418 (EPRI-CS/EA/AP—5663-SR, pp 3.43-3.56) **Hydraulic design of angled drum fish screens.** Johnson, P.L. (Bureau of Reclamation, Denver, CO (USA)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920262/JAW. (CONF-8710303—).

From Fish protection at steam and hydroelectric power plants; San Francisco, CA, USA (28 Oct 1987).

Angled drum screens, a recent development in fish control structures, are best suited for open channel applications such as on flow diversion canals. The concept combines angled screen placement to the flow, which minimizes fish impingement and maximizes fish guidance, with drum screens, which are proven cost effective traveling screens. For optimum guidance the approach flow to the screens should be eddy and slack water free, the flow field through the screens should be uniform and should comply with velocity criteria, and the flow into the bypass intakes should be uniform or gradually accelerating. Parameters influencing hydraulic performance include initial flow distribution, intake and exit channel geometry, intake and exit channel losses, head losses across the screens and screen structure, and geometric details of transitions, screen structure, and bypass intake. This paper presents hydraulic design guidelines that were developed through use of three site specific physical model studies and through use of a generalized hydraulic model study.

56419 (EPRI-CS/EA/AP—5663-SR, pp 3.57-3.72) **Hydraulic model evaluation of the Eicher passive pressure screen fish bypass system.** Wert, M. (Shapiro and Associates, Inc., Seattle, WA (USA)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920262/JAW. (CONF-8710303—).

From Fish protection at steam and hydroelectric power plants; San Francisco, CA, USA (28 Oct 1987).

A hydraulic model of a passive pressure screen fish bypass system was evaluated at the University of Washington Harris Hydraulics Laboratory, Seattle, during 1984 and 1985. Stainless steel wedgewire screen, inclined at 10.5, 16.5, or 30 degrees to horizontal, was tested in a Plexiglas conduit. Vertical velocity profiles above and below the screen were determined in conjunction with releases of dye. Fish were monitored by video camera and recorder as they passed through the pressurized model. Species tested included rainbow trout (Salmo gairdneri) and smolts of coho salmon (Oncorhynchus kisutch), a chinook salmon (O. tshawystcha) and steelhead trout (S. gairdneri). Screen angle, bypass and inflow water velocities, lighting and screen types were varied during the evaluation. Fish impingement was predictably avoided or produced by manipulation of inflow and bypass velocities, and was most prevalent at inflow velocities less than 4 feet (1.2 m) per second. Variations in the velocity vector perpendicular to the screen were inconsequential in effects on fish over a tested range of 0.4 to 3.0 feet (0.1 to 0.9 m) per second. Scale loss, evaluated for smolted fish contacting the screen, did not occur to steelhead trout or coho and chinook salmon. No delayed mortality was observed for any species within 72 hours after testing.

56420 (EPRI-CS/EA/AP—5663-SR, pp 4.1-4.25) **Fish protection: sonic deterrents.** Patrick, P.H.; McKinley, R.S.; Christie, A.E.; Holsapple, J.G. (Ontario Hydro Research Division, Toronto (Canada)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920262/JAW. (CONF-8710303—).

From Fish protection at steam and hydroelectric power plants; San Francisco, CA, USA (28 Oct 1987).

Two sound emitting devices were developed as alternatives to a pneumatic popper as a method to control fish at generating stations. One device, the fishdrone, uses sonic vibrations to excite a metallic structure at selected resonance which is then transmitted into the water column. The fishdrone is flexible in that fundamental frequencies ranging from approximately 20-1000 Hz can be generated. This is an unique aspect of this device since some species may respond more to some frequencies than others. In the Lennox Generating Station's forebay, preliminary experiments indicated that some fish displayed an avoidance response to the fishdrone but only at specific frequencies. The second device, the fishpulser or hammer, is a spring-mass impact device which produces a repetitive sharp sound of low fundamental frequency and high amplitude,

similar to that produced by a pneumatic popper. At the Pickering Diversion Structure, the hammer was effective in excluding adult alewife (Alosa pseudoharengus). Both devices show promise as an efficient and low cost method of controlling movement of some species in the vicinity of power plants.

56421 (EPRI-CS/EA/AP—5663-SR, pp 4.26-4.52) **Biological evaluation of behavioral barrier devices at a power plant intake located on the Hudson River.** Matousek, J.A.; Wells, A.W.; McGroddy, P.M.; Daley, M.W.; Micheletti, W.C. (Lawler, Matusky & Skelly Engineers, Pearl River, NY (USA)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920262/JAW. (CONF-8710303—).

From Fish protection at steam and hydroelectric power plants; San Francisco, CA, USA (28 Oct 1987).

As part of a four-year field test program to evaluate the effectiveness of behavioral barriers at power plant cooling water intakes, the Electric Power Research Institute (EPRI), in association with several member utilities, sponsored a study at Central Hudson Gas & Electric Corporation's (CHGE) Roseton Generating Station in 1986. The Roseton Station, located on the Hudson River, was selected for this study as representative of power plants with shoreline riverine intake systems. Three commercially available devices (air bubble certain, pneumatic gun, and underwater strobe lights) were tested alone and in combination to examine their effectiveness in reducing impingement during periods of peak fish abundance. Four 6-h collections were conducted during each test date, each consisting of two 3-h samples: one was an experimental test with a behavioral device in operation, the other a control test with no device operating. The order of the tests was selected randomly at the start of each test period, and the experimental device was chosen randomly at the start of each test period, and the experimental device was chosen randomly at the start of each test date. The effectiveness of the devices at excluding fish was determined by comparing impingement data during experimental and control periods.

56422 (EPRI-CS/EA/AP—5663-SR, pp 4.53-4.63) **Use of behavioral stimuli to divert sockeye salmon smolts at the Seton Hydro-Electric station, British Columbia.** McKinley, R.S.; Patrick, P.H. (Ontario Hydro Research Division, Toronto (Canada)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920262/JAW. (CONF-8710303—).

From Fish protection at steam and hydroelectric power plants; San Francisco, CA, USA (28 Oct 1987).

Field experiments were conducted on the effectiveness of selected behavioral systems in guiding or diverting downstream migrating sockeye smolts at the Seton Hydro-Electric station in British Columbia. Results indicated that strobe lights, pneumatic popper and hammer sound deterrents evoked an avoidance response in sockeye smolts even at a current velocity approaching 1 m/s. Percent exclusion was highest for the hammer (75%) followed by popper (66%), and strobe (56%) deterrents. These results clearly indicate the potential of behavioral methods to control salmon smolt migration at hydro-electric plants.

56423 (EPRI-CS/EA/AP—5663-SR, pp 4.65-4.73) **Conditions under which light attracts juvenile salmon.** Puckett, K.J.; Anderson, J.J. (Univ. of Washington, Seattle (USA)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920262/JAW. (CONF-8710303—).

From Fish protection at steam and hydroelectric power plants; San Francisco, CA, USA (28 Oct 1987).

When juvenile salmon encounter a sudden decrease in ambient light intensity, they may exhibit attraction to light. This response was investigated by adapting age 0 chinook salmon (Oncorhynchus tshawytscha) to a constant ambient light intensity (I/sub a/), followed by simultaneously reducing ambient light and producing a small spot of light (intensity I/sub s/) at the center of the test tank. Maximum attraction to the light, evinced by the number of fish above the light spot, was observed when I/sub s/ = I/sub a/. When I/sub s/ was 100 times I/sub a/, chinook actively avoided the light spot. The study indicates that ambient light levels must be considered when attempting to guide fish with lights.

56424 (EPRI-CS/EA/AP—5663-SR, pp 4-74) **Laboratory and field evaluations of fish protection systems for use at hydroelectric power plants: study update.** Taft, E.P.; Downing, J.K.; Sullivan, C.W. (Stone & Webster Engineering Corporation, Boston, MA (USA)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920262/JAW. (CONF-8710303—).

From Fish protection at steam and hydroelectric power plants; San Francisco, CA, USA (28 Oct 1987).

Protecting fish from entering hydraulic turbines has become an important objective of both regulators and utilities. In 1985 the Electric Power Research Institute (EPRI) initiated studies to evaluate the status of existing fish protection technologies and to identify the research and development needs to improve the effectiveness and reduce costs of several concepts which showed promise but had not been fully evaluated. In 1986, the first phase of the EPRI study was completed and results were presented in a detailed report. From the Phase 1 assessment it was clear the no single system existed which was biologically effective, operationally reliable, economically feasible, and acceptable to regulatory agencies. Therefore, it was recommended that five largely untested and potentially economical protection systems be tested at sites throughout North America. At the end of 1986, laboratory and field test sites were selected. Studies began in April 1987 and will be completed in November 1987. This paper presents results of preliminary analyses of available data.

56425 (STF—60A87120) **Eikelandsosen hydroelectric power station. Discharge of sediment-polluted water from hydro-power tunnels. Dispersion studies in Eikelandsfjorden.** (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Nov 1987. 51p. (In Norwegian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754908/JAW.

The report deals with a dispersion study of the sediment-polluted water from the Eikelandsosen hydroelectric power station into the Eikeland fjord in the county of Hordaland (Norway). The aim of the project was to investigate the effects from the discharged water on the existing fish farming plants in the area. 15 drawings.

56426 (STF—60A87145) **Ice lanes in lakes from submerged water power discharges.** Steen, J.E.; McClimans, T.A. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Dec 1987. 21p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754909/JAW.

The report presents basic methods for the evaluation and design of submerged hydro-power discharges in order to avoid ice lane formations in lakes. The method used for the design of a submerged discharge from the Lomen power station to Slidrefjorden in the county of Oppland (Norway) is presented. 11 drawings.

1307 Power-conversion Systems

56427 (EPRI-CS/EA/AP—5663-SR, pp 3.23-3.42) **Biological evaluation of Brayton Point Station Unit 4 angled screen intake.** Davis, R.W.; Matousek, J.A.; Skelly, M.J.; Anderson, M.R. (Lawler, Matusky & Skelly Engineers, Pearl River, NY (USA)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920262/JAW. (CONF-8710303—).

From Fish protection at steam and hydroelectric power plants; San Francisco, CA, USA (28 Oct 1987).

An 18-month (October 1984 - March 1986) biological evaluation study sponsored by New England Power Company (NEP) was conducted at the Brayton Point Station Unit 4 angled screen intake system located on Lee River/Mount Hope Bay, Massachusetts, the northeast portion of Narragansett Bay. The objectives of the testing program, which incorporated weekly sampling covering a complete diel period, were to determine (1) the numbers, species, and initial and extended survival of fish impinged on the modified intake screens or diverted from the angled screen intake; and (2) the diversion efficiency (DE) of the angled screens.

56428 (SESC—8806, pp 88-91) **Low and medium power hydroelectric turbines - Laval University laboratories.** Netsch, H.; Jean, Y.M. (Univ. of Laval, Que.; Fanny Industries, Sillery, Que.). 1988. (In French). Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

This paper describes the laboratory and the research activities at a Quebec facility investigating small scale hydroelectric turbines. Objectives of the facility include development of turbines having minimal maintenance, automatic operation, good quality output, and low manufacturing cost. An axial flow turbine has been developed. The machine can develop 11 kW maximum power and operates under very flexible conditions at a 4-8 m head. Another project involved installation of a 15.5 kW turbine in a remote site north of Quebec City; over 10,000 hours of operation have been achieved without major problems. Present work includes developing a 120 kW turbine for a 30 m head, and developing a microprocessor for control of low and medium power turbines. 1 fig., 1 tab.

14 SOLAR ENERGY

56429 **(NRC/E—NRCC-2049) Solar Energy Program contract registry, 1981-1982.** (National Research Council of Canada, Ottawa, Ontario. Div. of Energy). Jul 1982. 240p. (CE—01798). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This document is a record of all contract issued by the Solar Energy Program, National Research Council of Canada, that were either completed or ongoing in the fiscsal year 1981-1982. The contracts are grouped by system/application into seven categories: domestic hot water heating, passive solar heating, commercial/industrial process heating, photovoltaics, active space heating, core technology (common application), and agricultural applications. Within each category, contracts are grouped according to the type of study: fundamental studies, meteorological resource base, simulation and modelling studies, materials, technology, and product development, system development, system trials, instrumentation/monitoring/data analysis, test methods and standards, field trials, and analysis or information synthesis. For each contract there is a summary of work done, or a description of the proposed work plan, as well as data on the management and financial aspects availablility of the report.

56430 **(SESC—8806) Energy solutions for today.** (Solar Energy Society of Canada, Inc., Winnipeg, Manitoba). 1988. 342p. (CONF-8806251—; CE—01931). Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN.

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

In this conference examining various applications of solar energy, mainly in Canada, papers were presented in the following subject areas: solar energy use in developing countries, daylighting in buidings, remote site photovoltaic systems, private power systems (mostly small hydro), photovoltaic systems performance, solar energy in agriculture, solar collectors (theory and performance), solar utilization in commercial and industrial buildings, passive solar heating, solar domestic hot water heating, residential energy conservation, general solar energy issues, windows, ventilation systems, and active solar heating systems. Separate abstracts have been prepared for 59 papers from this conference. Includes author index.

1401 Resources And Availability

56431 **(A/ENR—8109) A solar energy atlas for Alberta.** Nkemdirim, L.C. (Alberta Energy and Natural Resources, Edmonton (Canada)). Sep 1981. 353p. (CE—01893). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This solar energy atlas has been based on data mainly derived synthetically from weather observations over a network of 52 climatological stations in Alberta and adjoining provinces. The atlas serves to indicate the practicality of solar energy applications in Alberta and to provide a convenient source of data on solar energy. The data are presented in the form of maps, diagrams and tables. These include the following: bright sunshine, global radiation, values of global radiation levels that will be exceeded with a given probability, daily persistence of global radiation, estimated average daily radiation at provincial locations with hourly weather observations, direct radiation, diffuse radiation; and global radiation on sloped surfaces. In addition, various statistics on cloud and precipitable water required for insolation estimation are included in an appendix. An introduction presents details of the solar irradiance model and calculation methods used. 8 refs.

56432 (SESC—8806, pp 267-271) **A study of the hourly distribution of the monthly-average ambient temperature and sky temperature in Canada.** Gueymard, C. (Bio-solar Greenhouses, Inc., Ham-Nord, Que.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

Based on climatic normals from five Canadian stations, a method is proposed to compute the hourly average ambient temperature from standard data, with higher accuracy than the existing models. A preliminary investigation for the estimation of the daily and hourly sky temperature is also proposed. Mean monthly temperature depressions between 5 and 26/sup 0/C are obtained at the six Canadian test stations. This result is not completely consistent with available US estimates, so that more research is necessary to obtain a reliable monthly-average sky temperature model for wide application in Canada. 23 refs., 2 figs., 2 tabs.

56433 (SESC—8806, pp 32-36) **Observing and modelling sky radiance and potential applications to daylighting design.** McArthur, L.B.; Morris, R.J.; Wardle, D.I. (Solar Instrumentation Research, Inc., Milton, Ont.; Atmospheric Environment Service, Downsview, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

A multi-waveband sky scanning radiometer has been developed, measuring radiance in 10 wavebands between the uv and the near infrared, including 5 between 300 and 700 nm. A single full-sky scan uses 62 locations at a 20/sup 0/ field of view, plus a further 5 locations using a 5/sup 0/ field of view for increased resolution near the solar disk. The time required to obtain a full-sky scan for the 10 wavebands is about 4 minutes. The design and operation of the instrument is reviewed. Analyses of individual sky radiance maps or significant wavebands are presented to illustrate changes in radiance patterns with changing wavelengths and solar position. The potential application of using a luminous efficacy model, developed and/or verified in part by the sky-scanner data, and the provision of natural illumination datasets for fenestration and energy systems design in buildings is discussed. 13 refs., 5 figs., 1 tab.

56434 (SESC—8806, pp 3) **Blockage of solar radiation by deciduous trees in winter.** Hughes, J.R. (Passive Solar Designs Ltd., Edmonton, Alta.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

A number of species of deciduous trees were observed and the amount of sunlight penetrating the leafless canopy on or about the winter solstice in Alberta was recorded. For some species, shading was negligible; a 6 m tall paper birch blocked only 20% of the available light but others blocked as much as 87%. Questions are raised about the validity of the axiom in solar design that it is acceptable, and perhaps even desirous, to plant deciduous trees to the south of a passive building. It was concluded that serious consideration should be given to the type of trees planted. The greater the light-blocking capacity of the tree, and the taller it is likely to grow, the further away it should be planted from the building. This gains in criticality as one gets further north, as the lower winter

sun angle increases the length of shadows cast. Measurements reported in this paper tend to indicate that larch, paper birch, and green ash cause the least shading, and that Manitoba maple, weeping birch, and mayday cause the most. 1 tab.

1403 Economics

56435 (SESC—8806, pp 3-6) **Photovoltaic, entrepreneurship and third-world development: an insight into setting up a solar energy industry in Sri Lanka.** Perera, V.; Gunaratne, L. (Power & Sun (Pvt) Ltd., Sri Lanka). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

This paper presents the story of a company that established a market in Sri Lanka for small scale photovoltaic power systems. A market survey and feasibility study showed that a significant number of households had no access to electricity from power mains, and a significant number of these households were using lead-acid batteries to power a small number of electricity consuming devices. An infrastructure was thus shown to exist for photovoltaic modules of the appropriate size. Financing was negotiated for a plant to produce two module sizes, one with a nominal power output of 35 watts and the other of 18 watts. A marketing program was set up, involving a travelling van used to demonstrate the products, advertising in local media, and consumer credit schemes to assist in purchasing the modules. A limited degree of tariff protection was obtained from the government. Results show considerable interest in the product, and sales to May 1988 total about 175 modules.

1404 Environmental, Legal, And Institutional Aspects

56436 (SESC—8806, pp 272-275) **A survey of solar site planning in Winnipeg.** Lam, V.; Rotoff, B.M. (Univ. of Regina, Sask.; Univ. of Manitoba, Winnipeg). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

In the last decade, most Canadian cities have accepted the principles of solar energy through development plans and/or zoning by-laws; however, in the housing market, the number of passive solar buildings has not shown an increase. Using Winnipeg as a case study area, this paper analyzes the potential for solar energy with good site planning and surveys builders on their use of solar design. The study methods involve an application of published criteria, an energy calculation using the computer program HOTCAN, and a tabulation of survey results by using the statistics program SAS. The results show that in Winnipeg, abundant solar energy is available with good site planning. Redistribution of window area to the south of the building yields considerably more energy saving than having window areas to the north. Lack of passive solar housing on the market arises from a public who are not ready to invest in this type of housing. It is concluded that the house-building industry has to change, such as including passive solar requirements in its architectural control guidelines. Public awareness programs concerning the utilization of solar energy are also needed. 1 ref., 8 figs.

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 56373, 56377, 56463, 56489, 56520, 56786

56437 **(CFS/SJN—FO46-15/261E) Study of photosynthetically active radiation and leaf development in a Salix energy plantation.** Dowsley, B.J. (Canadian Forestry Service, St. John's, Newfoundland). 1987. 45p. (MICROLOG—88-02373). Canadian Forestry Service, Place Vincent Massey, 351 St. Joseph Blvd., Ottawa, Ont., Canada K1A 1G5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Nilsson's (1983) equation, LA =mcxHxD. where LA is shoot leaf area, H is shoot length, D is shoot basal diameter and c is a coefficient, was tested on one year old shoots of Salix alba grown at an experimental energy plantation site in central Newfoundland during July and August 1986. The coefficient (c = 0.67) was derived from destructive measurements of shoot height and diameter, and the equation accurately predicted leaf area during the study period. Measurements of photosynthetically active radiation at the plantation site are also presented. 7 refs., 15 figs., 1 tab.

56438 **(CFS/SJN—FO46-15/260E) Study of the correlation of diurnal growth patterns to climatic variables in a Salix energy preparation.** Dowsley, B.J. (Canadian Forestry Service, St. John's, Newfoundland). 1987. 33p. (MICROLOG—88-02374). Canadian Forestry Service, Place Vincent Massey, 351 St. Joseph Blvd., Ottawa, Ont., Canada K1A 1G5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report examines the within-season growth patterns of three Salix clones at the Newfoundland Forestry Research Centre's Nursery at Pasadena during the 1985 growing season. Salix viminalis clone 0683 proved to be the most successful cultivar in terms of final mean height and base diameter achievement. This was attributed to its ability to continue growth later in the season as compared to the other two clones. Daily maximum height growth in all three species occurred between 14:00 and 22:00 hours NDST (Newfoundland Daylight Saving Time). Daily maximum base diameter growth occurred beween 22:00 and 06:00 hours NDST. Weekly climatic variables recorded at the study site are reported. 17 ref., 16 figs.

56439 **(CONF-870364—4) Biogasification of sorghum.** Biljetina, R.; Srivastava, V.J.; Isaacson, H.R. (Institute of Gas Technology, Chicago, IL (USA)). 1987. 19p. Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. Order Number DE88017157/JAW.

From 11. IGT conference on energy from biomass and wastes; Orlando, FL, USA (16 Mar 1987).

The Institute of Gas Technology has been operating a 1200-gallon, anaerobic solids-concentrating digester at the Walt Disney World Resort Complex in Lake Buena Vista, Florida. This digester development work is part of a larger effort sponsored by the Gas Research Institute to provide an effective community waste treatment and energy recovery concept for smaller communities. As a result, an economically attractive, water hyacinth-based wastewater treatment system was developed that includes the digestion of water hyacinth and sludge to methane. A further extension of the community waste treatment concept is to include agricultural wastes in the energy recovery scheme. Therefore, during 1986 a test program was initiated to obtain data on the digestion of sorghum in the solids concentrating digester. Performance data was collected at both mesophilic and thermophilic operating conditions at total organic loading rates of 0.25 and 0.5 pounds per cubic foot of digester volume per day, respectively. Excellent methane yields were obtained during twelve months of stable and uninterrupted operation. This paper summarizes the performance data obtained on sorghum in this digester. 7 refs., 6 figs., 6 tabs.

56440 **(CONF-8705302—1) Biogasification of sorghum in a novel anaerobic digester.** Srivastava, V.J.; Biljetina, R.; Isaacson, H.R.; Hayes, T.D. (Institute of Gas Technology, Chicago, IL (USA)). 1987. 22p. NTIS, PC A03/MF A01. Order Number DE88017160/JAW.

From 42. Purdue industrial waste conference; West Lafayette, IN, USA (12 May 1987).

The Institute of Gas Technology (IGT) conducted pilot-scale anaerobic digestion experiments with ensiled sorghum in a 160 ft^3 digester at the experimental test unit (ETU) facility at the Walt Disney World Resort Complex in Florida. The study focused on improving bioconversion efficiencies and process stability by employing a novel reactor concept developed at IGT. Steady-state performance data were collected from the ETU as well as from a laboratory-scale conventional stirred tank reactor (CSTR) at loading rates of 0.25 and 0.50 lb organic matter/ft^3-day at mesophilic and thermophilic temperatures, respectively. This paper will describe the ETU facility, novel digester design and operating techniques, and the results obtained during 12 months of stable and uninterrupted operation of the ETU and the CSTR which showed that methane yields anad rates from the ETU were 20% to 50% higher than those of the CSTR. 10 refs., 7 figs., 5 tabs.

56441 **(CONF-8708127—3) SRIC: Integration of production and harvesting system costs.** Woodfin, S.L.; Wright, L.L.; Curtin, D.T. (Oak Ridge National Lab., TN (USA); Tennessee Valley Authority, Norris (USA). Div. of Land and Forest Resources). 1987. Contract AC05-84OR21400;AI05-84OR21478. 35p. NTIS, PC A03/MF A01. Order Number DE89000437/JAW.

From International Energy Agency workshop on economic evaluations of short rotation biomass energy systems; Duluth, MN, USA (11 Aug 1987).

To achieve the objective of delivering woody biomass to the conversion plant at the lowest possible price, a systems approach in which both biomass production and harvesting costs are considered is required. In this paper, a method for combining biomass production and harvesting cost functions is developed to determine total system costs. Such an approach allows the analysis of how compromises within the function segments can improve total system performance. Efforts have been made to combine all research work in the Department of Energy's Short Rotation Woody Crops Program to create a total system analysis of biomass production. A new method for determining the best rotation age of multiple rotation hardwood stands is discussed. A regression equation of the favored rotation age in relation to planting density is formed. This relationship leads to other regressions of biomass yield to planting density and production (growing) costs to density. Harvesting productivity rates are simulated from research data for the range of tree sizes that plantations of various planted densities should produce. The production and harvesting costs for each density are combined in the form of present net worth and annual equivalent value and illustrated as a function of planting density. The results show a logarithmic increase in costs as planting density increases.

56442 **(CONF-8807107—1) The effect of alder forest cover and alder forest conversion on site fertility and productivity.** Van Miegroet, H.; Cole, D.W.; Homann, P.S. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 52p. NTIS, PC A04/MF A01. Order Number DE88016786/JAW.

From 7. North American forest soils conference; Vancouver, Canada (25 Jul 1988).

Red alder (Alnus rubra Bong.) is known for its ability to improve the status of soil N through symbiotic N fixation. The objective of this paper is to assess the effect of red alder forests and their removal on soil and solution chemistry and on the growth of trees subsequently established on such sites. This was achieved through a series of paired field comparisons at two locations in Washington, involving similar-aged pure alder and Douglas-fir forests on soils that were essentially the same prior to stand establishment. At Pack Forest alder and Douglas-fir stands on high- and low-productivity sites were subjected to three levels of harvesting: bore only removal, whole tree (aboveground) harvesting, and complete removal of all vegetation and forest floor. The effect of harvesting intensity was examined on nutrient removal with biomass and through leaching, and on subsequent seedling growth. At Thompson Research Center adjacent Douglas-fir and alder forests were harvested, and half of each area was replanted with either Douglas-fir or red alder seedlings, yielding four forest conversion units. Differences in growth patterns, tree nutrient status, and leaching losses between these conversion plots were examined. Compared with adjacent Douglas-fir forests, substantially more N, P, K_2 and Ca are tied up in aboveground vegetation and on the forest floor of alder forests, and these elements also cycle faster in alder ecosystems primarily due to the deciduous nature of alder.

56443 **(CONF-8807107—2) Twenty-year changes in biomass and nutrient distribution in forests of Walker Branch Watershed, Tennessee.** Johnson, D.W.; Olson, R.J.; Mann, L.K.; Todd, D.E. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 46p. NTIS, PC A03/MF A01. Order Number DE88016804/JAW.

From 7. North American forest soils conference; Vancouver, Canada (25 Jul 1988).

Changes in biomass and nutrient distribution in forests of Walker Branch Watershed from 1967 to 1987 are reviewed. There have been major changes in species composition in certain forest types: yellow-poplar (Liriodendron tulipifera) has largely been replaced by shortleaf pine (Pinus echinata) in what was formerly the pine forest type, and chestnut oak (Quercus prinus) appears to be replacing hickory in the oak-hickory forest type. In both cases, insect attacks (bark beetles and borers) precipitated the changes by inducing heavy mortality in native pines and hickory species in the 1970s. Subsoil (Bt horizon) exchangeable Ca^{2+} and Mg^{2+} have decreased markedly over a period of only 11 years in certain poor, upper-slope stands with oak and oak-hickory vegetation. From nutrient flux and mass balance analyses, we conclude that the Ca^{2+} changes can be attributed primarily to the sequestering of calcium in biomass. The situation with respect to Mg^{2+} is less clear; leaching was low relative to uptake in the one plot where Mg^{2+} decreases were statistically significant (95% level, t-test), yet it was clearly the dominant mechanism of Mg^{2+} export in all other plots where less significant (85% level, t-test) decreases were noted. It is noteworthy that leaching is dominated by SO_4/sup 2{minus}/, implying that acid deposition may be a major cause of the subsoil exchangeable Mg^{2+} decreases in some cases. 31 refs., 11 figs., 3 tabs.

56444 **(DOE/BP/18506—1) Surface soil disturbance and changes in soil properties after felling and yarding of fuelwood using a small cable yarder.** Shumway, J.; Schlichte, K.; Ryan, J. (Washington State Dept. of Natural Resources, Olympia (USA); Bonneville Power Administration, Portland, OR (USA)). Jul 1988. Contract AI79-85BP18506. 29p. NTIS, PC A03/MF A01. Order Number DE89001549/JAW.

This report summarizes a study which examined the effects of burning or yarding wood residues on soil surface disturbance, bulk density and selected chemical properties in the forest floor and top 15 centimeters of mineral soil. Neither burning nor yarding treatment caused significant changes in mineral soil chemical content. Chemical content and weight of the forest floor increased in the yarded units and decreased in the burned unit. Bulk density of surface soil was unaffected by treatment. Burning exposed much more mineral soil than did yarding. Season of yarding did not appear to influence soil surface disturbance, bulk density or mineral soil and forest floor properties. 26 refs., 2 figs., 1 tab.

56445 **(DOE/CE/15270—T7) Explorations of mechanisms regulating ectomycorrhizal colonization of boron-fertilized pine: Quarterly report, July 1, 1988-September 30, 1988.** Garrett, H.E.; Reid, R.K.; Sword, M.A. (Missouri Univ., Columbia (USA)). 1988. Contract FG01-86CE15270. 12p. NTIS, PC A03/MF A01. Order Number DE89000003/JAW.

This progress report describes efforts to determine if boron and IAA applied in combination to the roots of nonmycorrhizal shortleaf pine seedlings results in a greater downward flux of sucrose than when each is applied independently; to evaluate ectomycorrhizal-created endogenous increases of auxin (IAA) in shortleaf pine root systems receiving boron supplements and determine if the impact on carbohydrate flux resembles that in plants receiving exogenous boron and IAA; to determine the effects of hydroxylation

of phenolic compounds on the growth of Pisolithus tinctorius, a known ectomycorrhizal fungus, grown in pure culture; to evaluate the effectiveness of phenolase in metabolizing the most and least toxic phenolic compounds studied; and to determine the types and quantities of phenolic compounds produced by pine seedlings inoculated with Pisolithus tinctorius and receiving boron fertilization. Additional topics will be studied in future reports. 14 refs., 2 tabs.

56446 **(DOE/OR/21478—T2) Biomass harvesting and field handling tests: Final technical report for the period, 1 October 1987-30 September 1988.** Curtin, D.T.; Woodfin, S.L. (Tennessee Valley Authority, Muscle Shoals, AL (USA). Office of Agricultural and Chemical Development). 1988. Contract AI05-84OR21478. 25p. NTIS, PC A03/MF A01. Order Number DE89001628/JAW.

The decline of prototype developments and seasonal aspect of SRIC harvesting mandate examination of conventional logging machines. These machines can be practical provided sufficient stem size. 10 refs., 2 figs., 7 tabs.

56447 **(DU/B—P-40) Forest biomass and nutrient studies in central Nova Scotia. Part 4. Biomass and nutrients in ground vegetation, forest floor, soils and litterfall in a variety of forest stands.** Freedman, B.; Morash, R. (Dalhousie Univ., Halifax, Nova Scotia (Canada). Dept. of Biology). Aug 1985. 27p. (CE—01940). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Intensive forest harvest, such as whole-tree (above-ground) clearcutting, is known to have significant environmental impacts. One of the most important of these may be related to increasing rates of nutrient removals, due to harvesting of relatively nutrient-rich tissues, such as foliage, small branches, etc. Much of the available literature relevant to this problem of potential site impoverishment has recently been reviewed and interpreted by several authors (e.g. Kimmins 1977, 1980; Kimmins et al. 1979; Freedman 1981). This report presents the results of part of a research project whose objectives were to evaluate effects of intensive harvesting of forests for energy purposes on nutrient status and long-term productivity of an array of forest sites in central Nova Scotia. These were selected to represent a range of site classes, ages, and species composition. This research involved determination, for up to 16 forest stands, of quantities of biomass and nutrient in various above-ground components of all tree species, ground vegetation, forest floor, and mineral soils, and fluxes of biomass and nutrients in litterfall, ambient precipitation, stemflow, and throughfall. This report presents data from this study that describe quantities of biomass and nutrients in understory vegetation, annual litterfall, and forest floor and mineral soils. 19 refs., 7 tabs.

56448 **(JOY-KT—7) Biogasification of plant waste chopping.** Tenhunen, E.J.; Peltonen, P. (982039FI;). (Joensuu Univ. (Finland)). 1987. 315p. (In Finnish). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88754857/JAW.

The literature on biogasification of plant biomasses is reviewed. So far it is possible to calculate, the energy potential of Finnish plant-based biomasses is 7.3 petajoules per year. Biomasses not included are, for example, weakly decomposed surface peat and the utilizable part of tree biomass. In laboratory experiments, the decomposition of three plant biomasses, namely, potato haulm, tops of sugarbeet, and tops of jerusalem artichoke, was followed in 35 degrees Celsius. The total dry matter content of the masses in the beginning of the digestion was 20 per cent, the dry matter percentage of inoculum was 0.7 per cent, and in parts of experiments, the dry matter percentage of cattle manure or pig slurry was 19.3 per cent. The plant biomasses were dried before digestion to attain uniform dry matter conditions for the 1 liter bottles. Only potato haulm was really digested without manure addition. For potato haulm and jerusalem artichoke tops, pig slurry addition gave the best results; for sugarbeet tops, cattle manure supported the digestion of plant biomass. Next project combines composting and biogasification of plant biomass in a greenhouse system.

56449 **(ORNL—6440) Short Rotation Woody Crops Program: Annual progress report for 1987.** Ranney, J.W.; Ehrenshaft, A.R.; Layton, P.A.; McNabb, W.A.; Wright, L.L. (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 109p. NTIS, PC A06/MF A01. Order Number DE89001348/JAW.

This report describes the technical progress of the individual research projects in the Short Rotation Woody Crops Program (SRWCP) as well as synthesizing the results for an overview of the program. The program is sponsored by the US Department of Energy's Biofuels and Municipal Waste Technology Division and has the goal of developing a viable technology for producing renewable feedstocks for biofuels such as gasoline, diesel fuel, alcohol, and medium Btu gas in the United States. The most significant accomplishments have been the productivity rates achieved with Populus hybrids in the Pacific Northwest, the establishment of monoculture viability trials, the bioengineering developments of Populus spp. (hybrid poplar), and the initiation of wood-energy quality definitions in cooperation with biofuel conversion specialists. The most serious challenges are now seen as control of diseases in Populus, lowering cutting and handling costs, increasing productivity on moderate to poor soils in the South and Midwest, local matching and development of clones with sites in monoculture trials, and identifying and learning about the physiological and genetic variability of important growth qualities within model species for genetic improvement. 39 refs.

56450 **(SAND—88-0229) Evaluation and life testing of copper-coated alumina.** Beavis, L.C. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1988. Contract AC04-76DP00789. 55p. NTIS, PC A04/MF A01. Order Number DE89000629/JAW.

Metallized ceramics are commonly used substrates for solar cells in point-focus photovoltaic concentrator modules. A high percentage of failures in the copper-ceramic interface is occasionally found after thermal cycling. To better understand the cause of the failures, we prepared and thermally cycled several samples. Failed samples were found to contain purer alumina, had been fired at lower temperatures, and exhibited interfacial chlorine-probably from the flux used to apply the solder layer. The use of appropriate materials and processes should eliminate interfacial failure resulting from thermal cycling. 8 refs., 32 figs., 1 tab.

56451 **(SAND—88-0593C) The costs of photovoltaic concentrator modules.** Chamberlin, J.L. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 4p. (CONF-880965—5). NTIS, PC A02. Order Number DE89000501/JAW.

From 20. IEEE photovoltaic specialists conference; Las Vegas, NV, USA (26 Sep 1988).

The United States Department of Energy (DOE) has established 30-year levelized electricity cost goals for photovoltaically generated energy. These goals are $0.12/kWh for the near-term (early-1990s) and $0.06/kWh for the year 2000. The details of these goals are presented in DOE's Five-Year Research Plan. Sandia National Laboratories, which conducts and directs various photovoltaic (PV) research programs for the DOE, monitors the progress of industry in approaching these goals by periodically analyzing the projected costs of such power generation systems. The results of the most recent of these comparative studies for PV concentrator modules are presented in this paper. Based upon module cost projections supplied by six module developers, it is likely that the near-term goal could be met given sufficient production volume. Further cost reductions, which will require innovative module designs, are necessary to meet the longer-term goal. 6 refs., 5 figs.

56452 **(SAND—88-0600C) Measurement precautions for high-resistivity silicon solar cells.** King, D.L.; Gee, J.M.; Hansen, B.R. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 5p. (CONF-880965—4). NTIS, PC A02/MF A01. Order Number DE89000438/JAW.

From 20. IEEE photovoltaic specialists conference; Las Vegas, NV, USA (26 Sep 1988).

Due to features such as bulk carrier lifetimes on the order of 1 ms, excellent surface passivation, and light trapping, several measurement characteristics have been identified that are unique to high-performance, high-resistivity silicon cells. These unique characteristics can lead to large performance measurement errors. They also offer insight to the physical mechanisms occurring in these devices. Topics to be discussed and illustrated with measured results include a strong fill factor dependence on voltage sweep rate and direction, sublinear short-circuit current versus irradiance, light soaking influence on open-circuit voltage and fill factor, and enhanced spectral response beyond 1100 nm due to optical light trapping. (11 refs., 7 figs., 2 tabs.)

56453 **(SAND—88-0627C) The effect of parasitic absorption losses on light trapping in thin silicon solar cells.** Gee, J.M. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 6p. (CONF-880965—8). NTIS, PC A02/MF A01. Order Number DE89000457/JAW.

From 20. IEEE photovoltaic specialists conference; Las Vegas, NV, USA (26 Sep 1988).

Recently, methods to enhance the optical adsorption (i.e., light trapping) of thin silicon solar cells have been investigated by several groups. We have investigated the effect of parasitic adsorption (PA) losses on light trapping in thin silicon cells. Parasitic adsorption refers to an optical adsorption process which does not generate an electron/hole pair; it competes with band-to- band adsorption to decrease the photocurrent. A simple model for light trapping that includes PA is described for interpretation of experimental data. The sub-bandgap reflectance is shown to be a sensitive and quantitative indicator of PA losses. Finally, minimization of the PA losses is shown to be as important as optimization of the light-trapping geometry for increased photogeneration in light-trapping thin silicon solar cells. 12 refs., 7 figs.

56454 **(SAND—88-0630C) Crystalline silicon photovoltaic cell technology: Meeting the challenge for utility power.** Arvizu, D.E. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 9p. (CONF-880965—9). NTIS, PC A02/MF A01. Order Number DE89000439/JAW.

From 20. IEEE photovoltaic specialists conference; Las Vegas, NV, USA (26 Sep 1988).

This paper discusses the recent progress in U.S. crystalline silicon photovoltaic cell technology for both one-sun and concentrating applications. The progress in crystalline silicon technology has manifested itself in improved efficiency and in lower costs of processing and production. High efficiency cell designs that have been pioneered in the research laboratory are now finding their way into the production environment and we continue to project decreases in levelized energy costs for next generation systems over systems recently fielded in utility scale projects. The new developments in crystalline silicon photovoltaic technology have prompted an optimistic assessment of its potential for utility applications. The status of the current research efforts and the direction of the US Department of Energy sponsored crystalline silicon research program will be discussed. 20 refs., 6 figs.

56455 **(SAND—88-2564) A 31%-efficient GaAs/silicon mechanically stacked, multijunction concentrator solar cell.** Gee, J.M.; Virshup, G.F. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 5p. (CONF-880965—7). NTIS, PC A02/MF A01. Order Number DE89000460/JAW.

From 20. IEEE photovoltaic specialists conference; Las Vegas, NV, USA (26 Sep 1988).

Development and demonstration of a GaAs/silicon mechanically stacked, multi-junction (MSMJ) solar concentrator cell with an efficiency in excess of 30% is reported. This is the highest efficiency ever reported for a solar cell and this is the first solar cell to ever achieve an efficiency in excess of 30%. Our preliminary analysis suggests that an efficiency approaching 35% is possible with GaAs-based MSMJ cells. (22 refs., 2 tabs.)

56456 **(SAND—88-7027) Design of fault-tolerant circuits for photovoltaic concentrators.** Gonzalez, C.C.; Ross, R.G. Jr. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1988. Contract AC04-76DP00789. 69p. NTIS, PC A04/MF A01. Order Number DE89001062/JAW.

A methodology for fault-tolerant design of photovoltaic concentrator module and array circuitry presented. Results are provided in the form of example analyses and a complete set of curves giving array power loss versus fraction of open-circuit failures for a broad variety of series-parallel configurations with bypass diodes. Specific curves are provided for single, four, eight, and sixteen-parallel-string source circuits with varying bypass diode frequencies. An example case is presented in a step-by-step fashion to assist the module or array designer in using the above mentioned curves to calculate expected power loss for other concentrator designs. Optimum circuit configurations must also reflect the costs of incorporating circuit redundancy features and the life-cycle tradeoffs associated with repair and replacement of failed modules. To this end, module replacement strategies are also investigated based on a set of projected module and array costs. The results highlight circuit design configurations and module replacement strategies that maximize the array benefit to cost ratio. 7 refs.; 17 figs.; 2 tabs.

56457 **(SERI/SP—210-3357) US photovoltaic patents, 1951--1987.** (Solar Energy Research Inst., Golden, CO (USA)). Sep 1988. Contract AC02-83CH10093. 615p. NTIS, PC A99/MF A01. Order Number TI88001178/JAW.

This document contains 2195 US patents on terrestrial photovoltaic (PV) power applications, including systems, components, and materials as well as manufacturing and support functions. The patent entries in this document were issued from 1951 through 1987; no patents were found in 1950. The entries were located by searching USPA, the data base of the US Patent Office. The final search retrieved all patents under the class "Batteries, Thermoelectric and Photoelectric," and the subclasses "Photoelectric," "Testing," and "Applications." The search also located patents that contained the words "photovoltaic(s)" or "solar cell(s)" and their derivatives. A manual search of the patents in the Solar Energy Research Institute (SERI) patent file augmented the data base search. After the initial list was compiled, most of the patents on the following subjects were excluded: space photovoltaic technology, use of the photovoltaic effect for detectors, and subjects only peripherally concerned with photovoltaics. Some patents on these three subjects were included when it appeared that those inventions might be of use in terrestrial PV power technologies.

56458 (SESC—8806, pp 7-11) **Meeting energy needs of rural women.** Srivastava, J.C. (Council of Scientific & Industrial Research, New Delhi, India). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

This paper presents some methods of meeting energy needs of rural India, with emphasis on the kinds of tasks that rural women have to perform. These include cooking, heating, and pumping water. The scarcity of fuelwood and the disadvantages of using dung are overcome by using energy plantations to grow trees for fuel, cookstoves having improved thermal efficiency, methane fuel generated by means of animal and crop waste digestion, solar cookers, improved hand pumps, and photovoltaic powered water pumps. A carefully developed combination of renewable energy technologies and systems, plus efforts to secure their social acceptability, makes improvements in energy use possible through appropriate technology. 5 refs., 8 figs.

56459 **Recovery and reuse of cellulase catalyst in an enzymatic cellulose hydrolysis process.** Woodward, J. US Patent Application 6-098,242. 18 Sep 1987. 15p. Contract AC05-84OR21400. NTIS, PC A03/MF A01.

A process for recovering cellulase from the hydrolysis of cellulose, and reusing it in subsequent hydrolyois procedures. The process utilizes a commercial adsorbent that efficiently removes cellulase from reaction products which can be easily removed by simple decantation. 1 fig., 4 tabs.

56460 **Method of determining forest production from remotely sensed forest parameters.** Corey, J.C.; Mackey, H.E. Jr. US Patent Application 6-091,559. 31 Aug 1987. 63p. Contract AC09-76SR00001. NTIS, PC A04/MF A01.

A method of determining forest production entirely from remotely sensed data in which remotely sensed multispectral scanner (MSS) data on forest 5 composition is combined with remotely sensed radar imaging data on forest stand biophysical parameters to provide a measure of forest production. A high correlation has been found to exist between the remotely sensed radar imaging data and on site measurements of biophysical 10 parameters such as stand height, diameter at breast height, total tree height, mean area per tree, and timber stand volume.

1406 Photovoltaic Power Systems

REFER ALSO TO CITATION(S) 56435, 56458, 56698

56461 **(ESA-SP—267) Photovoltaic generators in space.** Burke, W.R. (European Space Agency, 75 - Paris (France)). Nov 1986. Vp. (CONF-8609216—). NTIS (US Sales Only), PC A21/MF A01. Order Number DE88780015/JAW.

From 5. conference on photovoltaic generators in space; Noordwijk, Netherlands (30 Sep 1986).

The 5th European symposium on photovoltaic power generators in space was held at The Hague, Scheveningen, Netherlands September 30 to October 2, 1986. Papers have been entered individually into EDB and ERA. (LTN)

56462 **(SAND—88-0557) Performance and characteristics of inverters in remote and stand-alone applications.** Bower, W.; Phillips, S.; Schalles, F. (Sandia National Labs., Albuquerque, NM (USA)). [1988]. Contract AC04-76DP00789. 7p. (CONF-880965—1). NTIS, PC A02/MF A01. Order Number DE88017348/JAW.

From 20. IEEE photovoltaic specialists conference; Las Vegas, NV, USA (26 Sep 1988).

The performance and characteristics of inverters and ac loads for remote and stand-alone photovoltaic applications have been evaluated as a cooperative effort at Sandia National Laboratories and at Murdoch University Energy Research Institute with similar results. The results of these evaluations are summarized. The compatibility and performance of the inverters and the loads are also presented with emphasis on total system efficiency and performance. The results show a critical need for minimum inverter specifications, categorizations of inverters, and guidelines for selection and use in the varied stand-alone applications. Techniques for making efficiency measurements and evaluation of the ac load performance are discussed. Recommended specification guidelines and inverter categorizations are discussed. 8 refs., 11 figs.

56463 **(SAND—88-2349) Photovoltaics as an operating energy system.** Jones, G.J.; Post, H.N.; Thomas, M.G. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 10p. (CONF-880932—2). NTIS, PC A02/MF A01. Order Number DE88017167/JAW.

From International renewable energy conference; Honolulu, HI, USA (18 Sep 1988).

In the short time since the discovery of the modern solar cell in 1954, terrestrial photovoltaic power system technology has matured in all areas, from collector reliability to system and subsystem design and operations. Today's PV systems are finding widespread use in powering loads where conventional sources are either unavailable, unreliable, or too costly. A broad range of applications is possible because of the modularity of the technology---it can be used to power loads ranging from less than a watt to several megawatts. This inherent modularity makes PV an excellent choice to play a major role in rural electrification in the developing world. The future for grid-connected photovoltaic systems is also very promising. Indications are that several of today's technologies, at higher production rates and in megawatt-sized installations, will generate electricity in the vicinity of $0.12/kWh in the near future. 12 refs., 3 figs.

56464 (SESC—8806, pp 110-116) **Big Trout Lake photovoltaic project first year performance.** Drewes, P. (Ontario Hydro, Toronto). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

The photovolatic system in Big Trout Lake, Ontario, has been in operation for more than one year. The installed cost of the system and the first year service requirements have been carefully documented. The system, as well as the community diesel plant, have been extensively monitored and the data produced have been used both for fault analysis and long term system evaluation. The Big Trout Lake system was operational for 282 days during the first year and produced 7,748 kWh of elecricity. Some minor power losses were experienced due to the wake-up controls and the power tracker but most of the problems were directly related to the interfacing with the diesel generators. Some modifications have been made to the photovoltaic components and the power conditioner has been made less sensitive to the utility system. 1 fig., 2 tabs.

56465 (SESC—8806, pp 105-109) **Field trial and characterization of a low-head photovoltaic pumping system.** Norman, C.E.; Thomas, R.E. (TPK International, Inc., Nepean, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

Small, photovoltaic (PV) powered irrigation systems, consisting of a PV array directly coupled to a dc motor driving a centrifugal pump, are being introduced into many developing countries. This paper describes the construction, laboratory testing and field trial of a PV pump system designed to provide 60 m/sup 3//d of water at a head of 7 m with an insolation of 18 MJ/m/sup 2/. The selected components were tested and then integrated into a complete system. Lab tests showed that the pump operated as designed, with a subsystem efficiency over 50% and a startup irradiance threshold around 325 W/m/sup 2/. The system was installed in a temporary field site in Ontario and operated for four months during the summer of 1987. Except for a few human errors, the pump system performed reliably; however, daily pumped volumes were lower than expected. After the trial, the components were retested, and the apparently reduced efficiencies were attributed to increased friction due to grease on the pump seal and to flow meter inaccuracies. Notwithstanding these minor problems, the field trail was successful. 2 refs., 4 figs.

56466 (SESC—8806, pp 99-104) **Photovoltaic powered pump performance from bright sunshine data.** Ward, P.R.B.; Dunford, W.G. (Ward & Associates Ltd., Vancouver, B.C.; Univ. of British Columbia, Vancouver, B.C.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

A method of using published data on hours of bright sunshine for predicting the performance of a photovoltaic (PV) powered pump at a remote site is described. The procedure is designed for use with a south facing photovoltaic array that is adjusted periodically so that it is perpendicular to the sun at the zenith. The procedure was first calibrated with data measured with an Epley pyranometer and a small PV monitor panel, and then independently checked by comparing the predicted and measured water volumes pumped by a directly driven PV powered pump. The predicted water volumes pumped over a period of 11 weeks were in excellent agreement with the water volumes measured in the field with a water flow meter. 5 refs., 4 figs., 1 tab.

56467 (SESC—8806, pp 79-84) **Tarryall Resort Photogenset power system demonstration.** LaPlace, R. (Photron Canada, Inc., Colinton, Alta.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

This paper describes the retrofitting of a continuously operating 7.5 kW diesel generator prime power system to a system which incorporated the use of photovoltaics in combination with the generator for energy input supply to a battery bank. The battery bank in turn supplies energy for direct operation of dc loads and for ac loads through a dc to ac solid-state inverter. The retrofitted system is called a Photogenset. The system offers dramatically decreased overall generator run-time, and greatly increased unit efficiency during these shortened periods of operation. This leads to substantial reductions in the areas of generator fuel consumption and maintenance requirements. Large increases in the service life of the unit also occur. This paper also describes the economic and environmental impact of the Photogenset installation. 4 refs., 3 tabs.

56468 (SESC—8806, pp 71-76) **Alternate energy power systems and their impact on the telecommunications industry in B.C.** Losie, B.J. (British Columbia Telephone Company, Victoria). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

The use of alternate energy power systems has been a series of ongoing experimental field trials for the British Columbia Telephone Company since 1982. The Company has at present over 20 sites, all remote radio repeaters, which are powered by alternate energy power systems. This paper discusses the types of power systems, problems encountered, and how these problems have been solved. Small photovoltaic systems have been installed at 17 sites, having peak loads of 50 watts at an average annual duty cycle of 10%. To date, two incidents resulting in loss of service have been reported. Cycle charge systems, designed for loads up to 400 watts, use combined photovoltaic array and diesel generator with associated batteries. Current systems are sized so that the diesel operates one day in six. Hybrid systems, using wind turbines, photovoltaics, and diesel were designed for loads over 400 watts, and are suited to north coastal regions with large wind regimes. The systems at Swindle and Calvert Islands are described in some detail, including their data logging and microprocessor controller systems. Problems have been encountered with damage to blades and with some of the diesel engine and generator components, but overall performance has been a qualified success. Examination of fuel consumption shows that similar sites operating with just a prime power generator system would have consumed over 8 times the amount of fuel in the same period. 1 fig., 2 tabs.

56469 (SESC—8806, pp 66-70) **Development of a photovoltaic powered reverse osmosis desalination system.** Norman, C.E.; Thomas, R.E. (TPK International, Inc., Nepean, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

Reverse osmosis (RO) is an efficient method for desalinating brackish water. In remote areas, photovoltaic (PV) modules can provide dependable, cost-effective power. A small, PV powered RO system can therefore be used to provide potable water in remote regions. This paper describes the development and testing of a prototype PV/RO system, designed to provide 1,000 l/d of drinking water. After testing, the system was operating automatically and monitored during a ten day trial period. It performed as expected, providing more than the required volume during a typical 18 MJ/m/sup 2/ day, at an energy cost of less than 10 kJ/l. 3 figs., 1 tab.

56470 (SESC—8806, pp 55-65) **Design of a remote residence photovoltaic DC power system.** Drewes, P. (Ontario Hydro, Toronto). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

The photovoltaic system considered in this study is a small, low cost 12 Vdc system with a peak output of several hundred watts. The system would provide limited energy, enough for a few lights, a radio and small appliances. Application is directed to the very small remote communities where no utility service is available. Several such communities, small remote native settlements, have been identified for northern Ontario. Site visits were made to these settlements to discuss the potential electrical needs with community representatives. The availability of sunshine for these sites is based on actual radiation measurements made at Big Trout Lake over the past two years. Detailed data for this site were analyzed using a LOTUS 1-2-3 PC program and a unique methodology was developed for sizing a generic photovoltaic array and battery storage system. Validation of the system design would be done by monitoring of actual systems to be installed at the recommended site. 8 figs., 2 tabs.

56471 (SESC—8806, pp 5) **Demonstration of a 4.2 kW photovoltaic system at the Baxter Interpretive Centre, Kars, Ontario.** Thomas, R.E.; Baertschi, E.; Norman, C.E. (TPK International, Inc., Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

A 4.2 KWp photovoltaic (PV) system was officially opened in Kars, Ontario, in January 1988. The system was aimed at demonstrating the technical and economic viability of a stand-alone PV system to power various appliances for an off-grid health/administrative centre in rural communities in Canada or developing countries. This paper describes the design and implementation of the system and its accompanying monitoring system, and presents some performance results. The electical energy used fluctuated within the projected load figures of 5-8.6 kWh/d and the energy collected ranged from 7 to 12 kWh/d. It was generally found that the system more than meets design specifications. 4 figs., 2 tabs.

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 56490, 57269

56472 **(IRAD—8404) A design concept for a solar facility capable of serving as a primary energy source.** (IRAD Corp., Kanata, Ontario (Canada)). Mar 1984. 21p. (CE—01788). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This proposal outlines a reference design for using solar energy on a very large scale. It discusses the development of concepts for very large seasonal energy storge facilities, the development of concepts for heat distribution networks that can handle high temperatures, and the development of a systems design for a network of collectors, energy storage facilities, converters and energy distribution links, suitable for integration into urban centers. The present concept for the reference design uses concentric layers of hematite sensible heat storage material. The outside blocks would be relatively cool and would serve as the storage for the heat for space heating. The inner layers would be progressively hotter in three additional temperature zones, the number of layers per zone depending on the season and the energy markets to be served. The remainder of the system would be comprised of the collectors, heat redistribution facility, two electric power generators, and heat distribution systems as required. The system is unusual in that it is able not only to accept energy from sources having widely different output temperatures but also to collect heat from the collectors during overcast periods when the delivery temperature is below the nominal value, thus improving the system efficiency. The prospects are very good that the cost per unit of energy delivered will be lower because the designs allow for efficient collection and delivery of energy, backup facilities are eliminated, and the large size allows economy of scale. Systems that combine solar and wind or hydro energy sources would be particularly cost effective. 1 fig.

56473 Development of an integrated heat pipe-thermal storage system for a solar receiver. Keddy, E.; Sena, J.T.; Merrigan, M.; Heidenreich, G.; Johnson, S. (Los Alamos National Lab., NM (USA); Sundstrand Corp., Rockford, IL (USA); NASA, Lewis Research Center, Cleveland, OH (USA)). pp 6 of Thermophysics, plasmadynamics and lasers conference. New York, NY; AIAA (1988). (AIAA-Paper—88-2683; CONF-880676—).

From Conference on thermophysics, plasma dynamics and lasers; San Antonio, TX, USA (27 Jun 1988).

An integrated heat pipe-thermal storage system was developed as part of the Organic Rankine Cycle Solar Dynamic Power System solar receiver for space station application. The solar receiver incorporates potassium heat pipe elements to absorb and transfer the solar energy within the receiver cavity. The heat pipes contain thermal energy storage (TES) canisters within the vapor space with a toluene heater tube used as the condenser region of the heat pipe. During the insolation period of the earth orbit, solar energy is delivered to the heat pipe. Part of this thermal energy is delivered to the heater tube and the balance is stored in the TES units. During the eclipse period of earth orbit, the stored energy in the TES units is transferred by the potassium vapor to the toluene heater tube. A developmental heat pipe element was constructed that contains axial arteries and a distribution wick connecting the toluene heater and the TES units to the solar insolation surface of the heat pipe. Tests were conducted to demonstrate the heat pipe, TES units, and the heater tube operation. The heat pipe element was operated at design input power of 4.8 kW. Thermal cycle tests were conducted to demonstrate the successful charge and discharge of the TES units. Axial power flux levels up to 15 watts/sq cm were demonstrated and transient tests were conducted on the heat pipe element. Details of the heat pipe development and test procedures are presented.

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 56812, 56813, 56820, 56824, 56835, 56840

56474 (AFME—84-0097-9) Study of the heat transfers through a variable transparence wall containing phase transition materials. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). 1985. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754969/JAW.

The effects of the optical characteristics (transparency, reflectivity) of a phase change material and of the material container on the collection and the storage of solar heat and also on the natural lighting properties of the wall material are studied. The heat transfers and the material properties are modelized. The phase change material solar modules are then optimized through a computer simulation.

56475 (DTH-LV-MEDD—191) Cost benefit analysis of three solar heating systems for domestic hot water supply. Furbo, S. (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering). 1988. 71p. (In Danish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754852/JAW.

The aim of the project was to develop small solar heating systems for domestic hot water supply with a 30% improvement of the ratio between the total yearly saved energy and the costs of the system compared with the systems marketed in Denmark in 1985. Three systems were investigated: A traditional system consisting of a hot water tank with a built-in heat exchanger spiral, a drain-back system and a system making use of an existing hot water tank. The cost of the traditional system, using a hot water tank with a built-in heat exchanger spiral, which was built in 1985 and had a collector area of 4.3 m/sup 2/, was 18,500 kr. incl. VAT and excl. government subsidies. This corresponds to a price reduction of about 30% compared to the normal systems marketed by BATEC in 1985. The performance of the system was as high as the performance of normal marketed systems.

56476 (NRC/BR—199) HUDAC Mark XI research project. Performance of solar heating system, 1979-1980. Building research note, No. 199. Sibbitt, B.E.; Carscallen, W.E. (National Research Council of Canada, Ottawa, Ontario. Div. of Building Research). Nov 1982. 19p. (CE—01794). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A project was undertaken to study energy use in four detatched houses located in a housing development near Ottawa. One of the objectives of the project was to evaluate the performance of the air-based solar heating system installed on one of the houses, and to compare its energy saving measures. The solar system was monitored in some detail through the 1979-80 heating season. This note descibes the operational experience with the solar system and presents an evaluation of its performance, including the net energy savings and the effect of the system on building performance. As originally installed, the solar system did not perform to design expectations. Following a more careful commissioning process, the performance approached that predicted by the manufacturer, supplying approximately 45% of the annual space and service water heating energy. This particular solar system had considerable air leakage which reduced system performance, increased the house heat load, overheated the indoor space, and, by pressurizing the indoor space, increased the risk of moisture damage to the building envelope. The system was intended to show the potential energy savings with air-type solar systems available at the time of installation (1976-77). It also served to indicate those areas requiring further system development, such as the air leakage problem and moisture accumulation within the collectors. 8 refs., 6 figs., 2 tabs.

56477 (NSERC—2470-2-4) Active solar air systems workshop summary. (Natural Sciences and Engineering Research Council of Canada, Ottawa, Ontario). 1982. 16p. (CONF-821260—; CE—01787). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

From Active solar air systems workshop; Ottawa, Canada (8 Dec 1982).

The topic of this report is a workshop on active solar air systems held in 1982 in Canada. The workshop was organized by Canada's Solar Energy Program to further communication on the state of the art and to identify promising applications and future research areas. This report summarizes the workshop presentations, which include investigation of the principles of solar air collectors, air handling and distribution systems, rock bed heat storage systems, solar wall collectors, domestic hot water heating systems, solar crop drying systems, and commissioning and monitoring experience with air-based solar systems. It was seen that promising and cost-effective applications of solar air systems will have to have some or all of the following characteristics: year round operation, no storage required, ability to displace expensive fuel requirements, ability to operate only when there is enough insolation or have an integrated back-up system, ability to displace the need for utilities to meet high peak loads, and presence of a large potential market or adaptability to different applications. 13 refs., 1 tab.

56478 (SESC—8806, pp 333-337) Comparative analysis of experimental and simulated behavior of the AHHRF solar heating module. Leung, E.Y.; Sadler, G.W. (Univ. of Alberta, Edmonton). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

The dynamic operation of the active air solar heating system installed in Module 6 of Alberta Home Heating Research Facility is studied by experiment and simulation. The simulation program used in the analysis is the TRNSYS program. The analysis includes the response of the system for sunny and cloudy days, and the daily variation in the total supply of solar and electric energy for warm and cold months. A balance for the system energy flow is also presented. 3 refs., 7 figs.

56479 (SESC—8806, pp 325-327) **Predicted and monitored performance of the Ford solar wall system for preheating ventilation air.** McClenahan, D.; Carpenter, S.; Bergevin, B. (Energy, Mines and Resources, Ottawa, Ont.; Enermodal Engineering Ltd., Waterloo, Ont.; INRS-Energie, Varennes, Que.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

Canada's largest solar air heating system, with close to 2,000 square metres of site-built wall collectors, began operation in late 1986 at the Ford Motor car assembly plant in Oakville, Ontario. The retrofit solar wall system is used for preheating ventilation air. The system incorporates standard building wall components including fibreglass insulation, corrugated steel wall cladding for the absorber, and a translucent fibreglass reinforced plastic glazing. Detailed monitoring of the performance of one section of the wall began in mid-December 1987. Approximately five months of data have now been analysed and a comparison with predictions using the SIMAIR computer program is presented. 4 figs.

56480 (SESC—8806, pp 242-247) **Natural convection heat exchangers in solar water heating system: theory and experiment.** Parnet, M.G.; van der Meer, T.H.; Hollands, K.G.T. (Univ. of Waterloo, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

Natural convection heat exchangers can be used in domestic hot water solar systems to replace the pump on the tank side of the exchanger. There is currently no experimentally verified way of designing this type of heat exchanger. An experimental apparatus to test natural convection heat exchanger was built. A finite volume numerical solution for the exchanger, including the effects of external piping, is presented. Comparison with experimental data from a shell-and-tube heat exchanger is performed. 6 refs., 5 figs., 1 tab.

56481 (SESC—8806, pp 236-241) **Effect of plume entrainment in the storage tank on calculated solar system performance.** Lighstone, M.; Hollands, K.G.T.; Hassani, A.V. (Univ. of Waterloo, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

The efficiency of a solar hot water system can be significantly increased by maintaining thermal stratifaction inside the storage tank. The effect of timestep used in the simulations on the predicted efficiency is studied and the results indicate that by decreasing the timestep the stratification inside the tank increases resulting in an increase in the solar fraction. The effect of plume entrainment on the calculated efficiency is also studied. This physical phenomenon showed a significant effect on the efficiency of the system, specially at low flow rates. 8 refs., 3 figs.

56482 (SESC—8806, pp 230-235) **Assessment of seasonal SDHW system freeze protection.** Sibbitt, B.E. (Ontario Research Foundation, Mississauga). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

Seasonal solar domestic hot water systems generally employ some means of freeze protection to extend their operating season into periods when mild freezing conditions may occur. Tests have been undertaken to investigate the effectiveness of the freeze protection methods used. A thermosyphon system, an integral collector storage system and a pumped recirculation system were tested in an environmental control chamber at 0, -10 and -20/sup 0/C. They were tested with all freeze protection systems operational and with individual protection devices disabled one at a time and in combination. The test results show a wide range of freeze protection capabilities and some improvements are suggested. Twenty-five years of weather data for Vancouver and Ottawa were processed and combined with the results of the freeze testing to define season lengths for the three systems. 9 refs., 6 figs., 3 tabs.

56483 (SESC—8806, pp 217-221) **Operational strategies for a sunspace in a northern climate.** Lumbis, A.; Schoenau, G.J.; Besant, R.W. (Univ. of Saskatchewan, Saskatoon). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

This paper presents several operating strategies available for a sunspace located in Saskatoon, Canada. A finite difference model of the sunspace was developed and verified from field measurements. Yearly simulations using typical meteorological data were performed to investigate the effect of these strategies on the auxiliary energy requirements of the sunspace. Both the heating and cooling load characteristics were investigated. The sunspace was found to be a net consumer of energy when operated as a living space for the complete year. Isolating the sunspace and using it as a preheater for an air-to-air heat exchanger during the winter months is the most energy efficient option. 2 refs., 8 figs., 2 tabs.

56484 (SESC—8806, pp 207-211) **How passive solar homes work in Canada.** Alward, R.; Mayo, T.; Hamilton, B. (Memphremagog Community Technology Group, Mansonville, Que.; Energy, Mines and Resources Canada, Ottawa, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

Since 1982, low-cost instrumented monitoring has been carried out on over twenty passive solar homes across Canada. This paper summarizes the performance of eighteen of these buildings. Most of the houses contain direct gain systems, several have sunspaces and many are superinsulated. All were designed to provide significant passive solar contributions to the heating load. The information presented includes building physical and thermal characteristics, heating season energy summaries, building performance factors and graphs comparing the performance of the eighteen buildings. 3 refs., 5 figs., 2 tabs.

56485 (SESC—8806, pp 201-206) **Development of a computer model to predict overheating in passive solar houses.** Yuill, G.K.; Gin, K. (G.K. Yuill & Associates Ltd., Winnipeg, Man.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

Measures taken in passive solar housing to maximize solar gains in winter may cause summer overheating due to excessive solar gains. Past techniques used to predict the extent of this overheating have either required a great deal of computational effort or have been of limited accuracy. Techniques such as the modified bin method base their calculations on monthly average values of insolation and ambient temperature, and require very few calculations. This can cause inaccuracies for two reasons. Firstly, the time coincidence of building solar gains and outdoor temperature is lost. As well, the term "passive solar housing" is used to describe a wide range of houses with widely differing insulation and thermal masses. The simplified methods often cannot model varying thermal mass levels. An overheating model was developed that performs a hourly heat balance for one typical day in a month. For each hour of the typical day, a statistical distribution of ambient temperature for that hour during the month is determined. From this, the overheating can be evaluated on a montly basis. A computer program using this algorithm requires substantially less computative effort than an hourly heat balance, while producing more accurate results than methods using monthly mean data. This overheating algorithm inherently accounts for the increased overheating during the middle of the day due to the coincidence of high solar gains and high outdoor temperatures. A correction to the overheating because of varying thermal masses is also made. The values of overheating predicted by this technique agree closely with predictions of over-

heating by more complex hourly heat balance models. 5 refs., 4 figs.

56486 (SESC—8806, pp 183-187) **Thermal performance of passive solar low-rise office building.** Yuill, G.K.; Gin, K. (G.K. Yuill & Associates Ltd., Winnipeg, Man.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

A low-rise office building with passive solar features was evaluated with a calibrated modelling technique. This building has a large amount of glazing incorporated into its design. Building temperatures, system performance, energy consumption, ambient temperatures and solar radiation levels were continuously monitored for 2 periods of about one week. These monitored data were used to calibrate a BLAST computer model of the building. Discrepancies between monitored and predicted parameters were analyzed, and the computer model adjusted to provide a better prediction of building performance. To take into account the effect of the most identifiable passive solar component of the building (the insulated glass fiber glazings in the atrium skylight and south face), the computer model was run with the glazings in place and with the glazings replaced with non-glazed wall and ceiling sections. The presence of this glazing was found to have an insignificant effect on the overall heating requirements, and there were heat losses through the translucent panels during the night. The calibrated modelling techniques proved to be successful in evaluating this building. However, a significant amount of effort and judgment is required in both acquiring and monitoring data and the subsequent calibration of the computer model. This effort suggests that the calibrated modelling technique may be of greater use as a research tool rather than a design tool. 4 figs.

56487 (SESC—8806, pp 132-137) **Solar-assisted heating of livestock buildings in the Canadian prairies.** Sokhansanj, S.; Barber, E.M. (Univ. of Saskatchewan, Saskatoon). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

The performances of three solar collection and storage systems to supplement heating of a swine gestation and farrowing barn in Saskatoon have been recorded since 1982. In one experiment, the south-wall of a farrowing room was fitted with a masonry concrete wall 0.2 m thick. The face of the wall was painted black and covered with clear corrugated fiberglass to capture solar heat. The wall was continuously ventilated with outside air flowing into the barn. The recorded data during the 1982-83 heating season showed that the wall collected an average of 1.75 kWh.m/sup -2/ daily. On an annual basis, the collected heat provided about 50% of the heat demand of the farrowing space. In another set of experiments, the south-wall of a gestation room in the same building was fitted with two suspended plate collectors. Four hundred plastic containers, half of which were filled with Galuber's salt and half with water, were used for thermal storage. The recorded data during the 1984-85 heating season showed that the wall collected an average of 2.33 kWh.m/sup -2/ daily. The overall collection efficiency was about 61% and the contribution to the annual heat requirement of the building was 48%. Water underwent freeze and thaw cycles, storing heat in the forms of sensible and latent heat. The salt did not show any sign of freeze and thaw cycles, storing heat only in the form of sensible heat. 7 refs., 3 figs., 3 tabs.

56488 (SESC—8806, pp 127-131) **Development of an improved indirect natural convective solar rice dryer.** Oosthuizen, P.H.; Sheriff, A.Y. (Queen's Univ., Kingston, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

The drying of rice in many Third-world countries is still accomplished by spreading it in a thin layer on the ground on a hard surface. Significant reductions in the losses that occur during drying could be achieved by replacing this method of drying by some form of indirect free convective solar rice dryer. The present study was undertaken in order to try to develop a set of guidelines for the design of such dryers. The study involved the development of a computer model of the dryer and a series of controlled laboratory scale experimental tests. The computer model has been used to derive a set of guidelines that can be used in the design of an adequate such dryer. The experimental study involved tests with three different types of dryer chamber. The performance of the various types of dryers tested has been compared by introducing a standardized drying rate. It is shown that the final dryer design tested, which was built according to a set of guidelines derived from the numerical study, provides a performance that is quite adequate for most applications. 11 refs., 4 figs., 1 tab.

1410 Solar Collectors And Concentrators

56489 (SAND—88-1235C) **A solar photochemical process for destroying organics in water.** Holmes, J.T.; Haslund, C.A. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 13p. (CONF-881054—6). NTIS, PC A03/MF A01. Order Number DE89000503/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

Recent scientific literature indicates the potential benefits of using photocatalytic oxidation reactions for the destruction of organic contaminants in water. The processes utilize solid or dissolved photon-activated catalysts to break down low concentrations of hazardous organic chemicals into carbon dioxide and simple acids. We are using concentrated sunlight to study a falling-liquid-film reactor that has the characteristics to effectively conduct these photochemical reactions. These include the ability to utilize high solar (photon) flux densities without overheating or evaporating the fluid or contaminants; excellent interactions, in the thin film of fluid, between concentrated sunlight, catalyst and contaminants in the fluid; the fluid is easily doped with reactants and solid or dissolved catalysts; high capacity; and easy process control. We investigated the maximum solar power capabilities of a pilot-scale (1m {times} 3.5m) falling-water-film reactor. Our thermal performance results indicate its potential as a photochemical reactor. 10 refs.; 3 figs.; 1 tab.

56490 (SAND—88-7025) **Development and evaluation of a tracking error monitor for solar trackers.** Galbraith, G. (EG and G, Inc., Albuquerque, NM (USA)). Oct 1988. Contract AC04-76DP00789. 37p. NTIS, PC A03/MF A01. Order Number DE89001661/JAW.

This report discusses the design and performance of an instrument used to measure the tracking error of sun-following trackers. The monitor was developed at the Sandia National Laboratories' solar test facility for use in testing photovoltaic concentrator modules and arrays that track the sun. Three versions of the tracking error monitor are described, having a range of precisions, acceptance angles, and noise immunity. The most precise can measure angular tracking error within 0.1{degree} over a view angle of +- 1.5{degree}. 20 figs., 1 tab.

56491 (SESC—8806, pp 338-340) **The effects of fluid flow rate on solar collector performance.** Harrison, S.J.; Nielsen, V.H. (Queen's Univ., Kingston, Ont.; Ontario Research Foundaton, Mississauga, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

Ongoing research to evaluate the effects of flow rate on thermal performance is being conducted for a variety of collector types and header geometries. To date, tests have been conducted on two collector types, a conventional flat plate collector, and a flat plate collector with a serpentine type absorber plate. Results of these test indicate a good agreement of measured data with classical equations relating collector performance and heat transfer fluid flow rate. 5 refs., 2 figs.

56492 (SESC—8806, pp 225-229) **Passive downward heat transport.** Rush, C.K. (Queen's Univ., Kingston, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

Concepts for transferring heat energy from a collecting location to a lower storing location without the use of work-driven pumps are described. These include heat pipes, bubble pumps, and vapour pressure driven liquid pumps. For each general concept, particular embodiments are described as well as features that have been patented. Working fluids that may be used are identified and their limitations discussed. The working principles of these devices are examined from a thermodynamics point of view in order to establish their operating limitations. In particular, the temperature differences needed to operate these devices are estimated and the impact on solar collector performance discussed. 8 refs. 4 figs.

56493 (SESC—8806, pp 170-174) **An environmental simulator for thermal performance testing of solar collectors.** Johnson, G.P.; Rush, C.K. (Queen's Univ., Kingston, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

An experimental apparatus has been constructed in Ontario which is capable of obtaining the information needed to characterize solar collectors under a variety of meteorological and operating conditions. The Environmental Simulator is an integrated test facility that allows the researcher to set test conditions, and log the measured performance by computer. Preliminary results of test performed on a boiling/condensing solar collector compare favourably to similar tests conducted at Canada's National Solar Test Facility. The unique feature of this facility is its ability to test the thermal performance of solar collectors over a range of ambient temperatures. 7 ref., 2 fig.s, 2 tabs.

56494 (SESC—8806, pp 161-165) **Thermal analysis of a non-uniformly irradiated solar fin.** Clemes, S.B.; Brunger, A.P. (Univ. of Waterloo, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

This paper shows that, in solar collectors, both the fin efficency, F. and the collector efficiency factor, F/sup 1/, are sensitive to the distribution of the solar irradiance upon the collector's absorber fins. By numerical analysis, it was found that the effect upon F and F/sup 1/, due to the location or irradiance of a solar fin, can vary +/-10% relative to the case of a uniformly irradiated fin, for typical solar fin geometries. These results have application to the class of nonimaging concentrating solar collectors which typically have non-uniform absorber irradiances. 3 refs., 6 figs., 1 tab.

56495 (SESC—8806, pp 155-160) **Concentration-transmission-absorption product for nonimaging solar collectors using ray tracing.** Mikkelsen, J.V.; Hollands, K.G.T.; Brunger, A.P. (Univ. of Waterloo, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada, K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

A novel approach has been developed to calculate the optical efficiency, or concentration-transmission-absorption product, for a troughlike nonimaging concentrating solar collector. The technique developed is a hybrid of analytical and ray tracing solutions. The collector is analysed using a classical radiation enclosure analysis in which all surfaces are modelled as possessing perfectly specular and diffuse components of reflectivity and or transmissivity. The analysis requires the determination of exchange factors between the sun and the collector surfaces through a semi-transparent glazing. A ray tracing algorithm calculates these factors by recording and summing the history of a number of rays. Results are compared to experimental ones. 9 refs., 3 figs., 2 tabs.

56496 (SESC—8806, pp 150-154) **The "mega-epsilon" collector: a low-concentration, non-imaging solar collector for CIPH in Canada.** Hollands, K.G.T.; Brunger, A.P.; Mikkelsen, J.V. (Univ. of Waterloo, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

A new collector is described which has fewer materials, has less mass, and is cheaper than conventional solar collectors. The design of the collector allows the possibility of building large arrays of the collector on site from rolled stock materials. The collector is of the non-imaging concentrator type, and consists of a finned tube absorber, an aluminum reflector which also serves as the collector box, and a plastic glazing. Two small prototype arrays have been tested, and the results indicate that the new collector should provide solar heated process water at a cost below that of other large-scale solar collector arrays 8 refs., 5 figs.

56497 (SESC—8806, pp 145-149) **A generalized performance representation for solar collector performance.** Harrison, S.J. (Queen's Univ., Kingston, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

The thermal performance of solar collectors has been widely represented by the well-known Hottel-Whillier-Bliss model of collector performance which, however, does not adequately represent the performance of a wide variety of solar collector types. A performance representation for solar collectors has been developed which allows for the prediction of collected energy under a range of irradiance levels, fluid inlet and ambient air temperatures. The relationship has been developed for a variety of collector types and allows for simplified test methods. This paper outlines the development of this five parameter model and details the test required to derive the performance coefficients. The fundamental basis of the model and its limitations are discussed. Theoretical and experimental test results have shown that good fits to the model may be achieved by setting two of the parameters to zero and conducting testing in the normal fashion at one irradiance level for conventional flat plate and evacuated tube collectors. For collectors that incorporate a phase change heat transfer fluid and integral condenser, testing is required at two irradiance levels. 10 refs., 6 figs.

56498 (SESC—8806, pp 166-169) **Utilization of a coaxial tube inside the water circulation collector in the case of evacuated tube collectors.** Valkov, V.; Leblanc, P.; Jean, B.; Bergevin, B. (INRS-Energie, Varennes, Que.). 1988. (In French). Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

The optimization of the dimensions of a coaxial tube inside the water circulation collector of evacuated tube collectors has been effected by using an iterative calculation algorithm, developed with the goal of analyzing heat transfer. The calculation gives, depending on the geometry and the parameters asked for, the heat flux, transferred to the liquid, and the heat transfer coefficients on the interior and exterior surfaces of the coaxial tube and on the collector surface. The results of the calculation permit determination of an optimal diameter for the coaxial tube which gives an increase in heat transfer taking into account at the same time the ease of installation of the coaxial tube and the load losses. Two collectors from the FET company, the first composed of 12 evacuated tubes without reflector, have been modified into collectors with coaxial tube. Some trials, carried out on the two collectors, show in the flow zone of 2.9 l/min to 6/6 l/min, an increase in heat flux, tranferred to the liquid, which can attain 15-20% in certain conditions. 2 refs., 3 figs.

1420 Heat Storage

REFER ALSO TO CITATION(S) 56474, 56487, 56835

56499 (SESC—8806, pp 251-254) **Legalett, a low-energy building system with foundation heat storage.** Borg, R.; Carter, C. (Legalett Canada, Peterborough, Ont.; Trent Univ., Peterborough, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

Legalett is a low-energy building system from Sweden, in which a heated concrete foundation slab is used for heat storage. A chemical additive creates small air pockets in the concrete and expands its volume by 11%. This saves cost and improves heat retention by lowering thermal conductivity. The slab rests on 20 cm of polystyrene insulation, and incorporates 10 cm diameter piping on 80 cm centres which can be used for various purposes, such as heating to facilitate winter pouring of the slab, recovering heat from waste water, and storing solar heat. The foam base is the only part of the building in contact with soil, and serves not only to insulate the slab but also as a barrier to radon gas. The cost of the system is absorbed by simplified construction and the absence of a basement or of heating and air-conditioning equipment. In 1987, nearly one half of all new foundations in Sweden used the Legalett system. Legalett houses are now proposed for several locations in Eastern Canada and USA. The first one in Keene, Ontario is now under construction. Due to the greater winter sunshine in Canada, both passive and active solar collection is a better option than in Sweden. Computer simulations of a Legalett home in Sweden and Canada are reported. 2 refs., 2 figs., 1 tab.

56500 (SESC—8806, pp 212-216) **Large scale tests on gypsum boards of high thermal inertia.** Paris, J.; Houle, J.F. (Parinova, Inc.; Ecole Polytechnique de Montreal, Que.). 1988. (In French). Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

With the objective of increasing the energy efficiency of homes using direct-gain passive solar heating, windows of high thermal resistance are used. In typical Canadian construction, where the thermal mass of rooms is low, a high solar gain through such windows brings about local overheating. In order to increase the thermal mass of rooms without changing their architecture, it has been proposed to incorporate phase change materials into commonly used gypsum board, as used on walls. This paper describes some research intended to combat this problem. Gypsum boards have been manufactured containing a phase change material in order to determine, in large scale tests, their effectiveness as a means of reducing overheating in houses using passive solar, direct-gain heating. The results of tests carried out in Quebec in early 1988 show that the use of these boards brings about an important reduction in overheating. With the experimental boards used, and in the conditions experienced, a reduction of overheating time (where the temperature is over 26 degrees C) of nearly 50% and a reduction of the degree-hours of overheat of 80%. 2 refs., 7 figs., 3 tabs.

15 GEOTHERMAL ENERGY

1502 Geology And Hydrology Of Geothermal Systems

56501 (SAND—87-2241) **In situ experiments of geothermal well stimulation using gas fracturing technology.** Chu, T.Y.; Warpinski, N.; Jacobson, R.D. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1988. Contract AC04-76DP00789. 102p. NTIS, PC A06/MF A01. Order Number DE89001050/JAW.

The results of an experimental study of gas fracturing technology for geothermal well stimulation demonstrated that multiple fractures could be created to link water-filled boreholes with existing fractures. The resulting fracture network and fracture interconnections were characterized by mineback as well as flow tests. Commercial oil field fracturing tools were used successfully in these experiments. Simple scaling laws for gas fracturing and a brief discussion of the application of this technique to actual geothermal well stimulation are presented. 10 refs., 42 figs., 4 tabs.

1503 Geothermal Exploration And Exploration Technology

56502 (SAND—88-0502) **Acoustical properties of drill strings.** Drumheller, D.S. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1988. Contract AC04-76DP00789. 61p. NTIS, PC A04/MF A01. Order Number DE89000630/JAW.

The recovery of petrochemical and geothermal resources requires extensive drilling of wells to increasingly greater depths. Real-time collection and telemetry of data about the drilling process while it occurs thousands of feet below the surface is an effective way of improving the efficiency of drilling operations. Unfortunately, due to hostile down-hole environments, telemetry of this data is an extremely difficult problem. Currently, commercial systems transmit data to the surface by producing pressure pulses within the portion of the drilling mud enclosed in the hollow steel drill string. Transmission rates are between two and four data bits per second. Any system capable of raising data rates without increasing the complexity of the drilling process will have significant economic impact. One alternative system is based upon acoustical carrier waves generated within the drill string itself. If developed, this method would accommodate data rates up to 100 bits per second. Unfortunately, the drill string is a periodic structure of pipe and threaded tool joints, the transmission characteristics are very complex and exhibit a banded and dispersive structure. Over the past forty years, attempts to field systems based upon this transmission method have resulted in little success. This paper examines this acoustical transmission problem in great detail. The basic principles of acoustic wave propagation in the periodic structure of the drill string are examined through theory, laboratory experiment, and field test. The results indicate the existence of frequency bands which are virtually free of attenuation and suitable for data transmission at high bit rates. 9 refs., 38 figs., 2 tabs.

56503 (SAND—88-1018) **Coring in deep hardrock formations.** Drumheller, D.S. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1988. Contract AC04-76DP00789. 38p. NTIS, PC A03/MF A01. Order Number DE89001058/JAW.

The United States Department of Energy is involved in a variety of scientific and engineering feasibility studies requiring extensive drilling in hard crystalline rock. In many cases well depths extend from 6000 to 20,000 feet in high-temperature, granitic formations. Examples of such projects are the Hot Dry Rock well system at Fenton Hill, New Mexico and the planned exploratory magma well near Mammoth Lakes, California. In addition to these programs, there is also continuing interest in supporting programs to reduce drilling costs associated with the production of geothermal energy from underground sources such as the Geysers area near San Francisco, California. The overall progression in these efforts is to drill deeper holes in higher temperature, harder formations. In conjunction with this trend is a desire to improve the capability to recover geological information. Spot coring and continuous coring are important elements in this effort. It is the purpose of this report to examine the current methods used to obtain core from deep wells and to suggest projects which will improve existing capabilities. 28 refs., 8 figs., 2 tabs.

1506 Environmental Aspects And Waste Disposal

56504 (BNL—41457) **Some aspects of geothermal waste treatment biotechnology.** Premuzic, E.T.; Lin, Mow. (Brookhaven National Lab., Upton, NY (USA)). Jun 1988. Contract AC02-76CH00016. 5p. (CONF-881045—5). NTIS, PC A02. Order Number DE88015196/JAW.

From Annual meeting of the Geothermal Resources Council; San Diego, CA, USA (9 Oct 1988).

Recent studies have indicated that biotechnological processes for detoxification of geothermal residual brine sludges are feasible. Preliminary studies have also shown that such processes are controlled by several factors which include the concentration of the residual sludge in the bioreactor, the type of bioreactor and the strain of acidophilic microorganisms used. A brief discussion of these factors follows. 5 refs., 3 figs., 4 tabs.

1509 Geothermal Engineering

56505 **(LBL—25710) Modeling of fluid and heat flow in fractured geothermal reservoirs.** Pruess, K. (Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC03-76SF00098. 7p. (CONF-881170—1). NTIS, PC A02/MF A01. Order Number DE88016636/JAW.

From International symposium on geothermal energy; Kumamoto, Japan (10 Nov 1988).

In most geothermal reservoirs large-scale permeability is dominated by fractures, while most of the heat and fluid reserves are stored in the rock matrix. Early-time fluid production comes mostly from the readily accessible fracture volume, while reservoir behavior at later time depends upon the ease with which fluid and heat can be transferred from the rock matrix to the fractures. Methods for modeling flow in fractured porous media must be able to deal with this matrix-fracture exchange, the so-called interporosity flow. This paper reviews recent work at Lawrence Berkeley Laboratory on numerical modeling of nonisothermal multiphase flow in fractured porous media. We also give a brief summary of simulation applications to problems in geothermal production and reinjection. 29 refs., 1 fig.

56506 **(SAND—88-1910C) Design and evaluation of lost circulation materials for severe environments.** Loeppke, G.E.; Glowka, D.A.; Wright, E.K. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 66p. (CONF-881012—5). NTIS, PC A04/MF A01. Order Number DE88014786/JAW.

From 63. Society of Petroleum Engineers (SPE) annual technical conference and exhibition: reservoir engineering; Houston, TX, USA (2 Oct 1988).

An independent analysis of lost circulation materials for geothermal applications has been completed using unique laboratory tools developed for the purpose. Test results of commercial materials as well as mathematical models for evaluating their performance are presented. Physical attributes that govern the performance of lost circulation materials are identified and correlated with test results. 9 refs., 27 figs., 4 tabs.

1520 Geothermal Data And Theory

REFER ALSO TO CITATION(S) 56505

56507 **TEM and X-ray study of orthopyroxene megacrysts: microstructures and crystal chemistry.** Veblen, D.R.; Bish, D.L. (Johns Hopkins Univ., Baltimore, MD (USA)). *American Mineralogist;* 73: No. 7-8, 677-691(Jul-Aug 1988).

Single-crystal X-ray diffraction and light microscopy indicate that orthopyroxenes with pronounced (100) parting contain lamellae of amphibole and/or oxides. Detailed transmission electron-microscopy (TEM) and analytical electron-microscopy (AEM) studies of an orthopyroxene megacryst from an anorthosite demonstrate that this pyroxene is a complex mixture of several different types of lamellae, which have been characterized by electron diffraction, TEM imaging, and AEM analysis. The lamellae include host orthopyroxene, magnetite, hercynite, ilmenite, calcic plagioclase, augite, clinoamphibole, complex hybrid lamellae containing both clinopyroxene and clinoamphibole, and other types of hybrid lamellae involving both silicates and oxides. Although optically the most obvious lamellae in this orthopyroxene megacryst are plagioclase and oxides, micrometer-sized to submicroscopic amphibole lamellae are by far the most abundant. Such amphibole lamellae are difficult to observe with standard petrographic techniques and may have been overlooked in previous studies of orthopyroxene megacrysts. Microstructures in the amphibole and in the hybrid pyroxene-amphibole lamellae indicate that amphibole formed by replacement of (100) exsolution lamellae of clinopyroxene. The presence of abundant amphibole suggests that this orthopyroxene megacryst experienced substantial hydrothermal alteration.

17 WIND ENERGY

56508 **(AA—85) Evaluation of small scale wind turbine for pumping water in Alberta.** (Alberta Agriculture, Lethbridge (Canada); Alberta/Canada Energy Resources Research Fund, Edmonton). 1985. 145p. (CE—01790). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The main objectives of this study were to evaluate the potential for wind turbines to efficiently pump water for agricultural uses and to monitor, demonstrate, and evaluate various types of windpumping equipment developed, made, or distributed in Canada. A test site was established in Alberta where a total of 6 different water pumping windmills were installed during 1983. Later, a solar pumping system and a small power generating wind turbine were also installed on the site. All of the units were monitored on a continuous basis during summer and fall of 1983 and 1984, with the generating unit monitored year round. A number of parameters were monitored for each of the water pumping turbines, with volume of water pumped relative to wind speed considered the most important. For the solar unit, water pumped versus solar radiation was considered important while for the electrical unit, power output versus wind speed was measured. The results of this study, particularly the demonstration aspects, have far exceeded expectations. They showed considerable differences among the various types of units. More importantly, however, the program points out the necessity of relating the pumping performance of each machine to the wind regime data for a given region, in order to predict the true capability of a given wind turbine. The data also point out that wind turbine manufacturers should put greater emphasis on designing machines to capture the low end of the wind spectrum rather than attempting to maximize power at the higher wind speeds. The data monitored at the Lethbridge test site was based on International Energy Agency wind turbine testing standards, and can be extrapolated and utilized throughout most of the world. 14 refs., 36 figs., 5 tabs.

56509 **(STADIA—9002089) Wind energy 1988: Wind turbine markets, shipments, and applications.** Jaras, T.F. (Stadia, Inc., Great Falls, VA (USA)). [1988]. 128p. Unlimited audience, publicly available. Circulation Department Stadia, Inc., P.O. Box 442, Great Falls, Virginia 22066. Order Number TI89002089/JAW.

This book is the second in a series of annual publications containing statistical information and analyses on the wind turbine market. It is the only authoritative source for worldwide wind turbine shipment and application information published in the world. The book is designed to serve as a reference document for wind industry marketing departments, planners and decisionmakers, and those monitoring the wind energy industry. 102 figs.

1704 Economics

REFER ALSO TO CITATION(S) 56513, 56518

56510 **(CREIC—8601, pp 6) Wind energy developments and opportunities.** Lacey, V.P. (Indal Technologies, Mississauga, Ont.). 1986. CANMET; $0.34CAN per page, $3.40 CAN minimum. (CONF-860124—; CE—01913).

From New energy sources: challenges and business opportunities; Toronto, Ontario, Canada (26 Jan 1986).

This paper outlines developments in wind turbines in Canada and the USA. These developments have led to large capacity machines that feed power into electric utilities. In the USA, this has been encouraged by tax incentives and from the decreasing cost of turbine technology. In Canada, one concept being examined is the hybrid diesel-wind generating system. The economics of wind energy are addressed briefly; an example of a 720 MWh project with long term financing is given which shows an energy cost of

7.9 cents/kWh which is competitive with diesel-produced electricity in many areas. However, it is recommended that the true costs of competing energy forms be determined before seeing whether wind power is economically advantageous or not. Future business opportunities in wind power are reviewed; studies indicate a potential $5 billion wind turbine generator market in the USA and a worldwide potential for wind power in remote communities of over 7000 MW.

56511 **(RISO-M—2661) Development of commercial Danish wind turbines.** Petersen, H. (Risoe National Lab., Roskilde (Denmark)). Oct 1987. 26p. NTIS (US Sales Only), PC A03. Order Number DE88754879/JAW.

The paper presents an examination of the development of commercial Danish wind turbines. The wind turbines surveyed are from 7 to 25 meters in diameter. Based on the catalogue prices of the machines and their dimensions curves are presented indicating the price for a range of rotor diameters and rated generator powers, i.e. price per square meter of the rotor disc area price per kW of rated generator power. Based on performance data prices of windmills are shown relative to the energy generation per square meter of rotor disc area in a given wind climate, thereby showing the economy of the windmills. Curves of the wind power utilization ratio and capacity factor are also shown. The general conclusion drawn at is that within the range of sizes considered it would be most economical to choose windmills to be as large as feasible for the application in question. Technical features of the windmills are also surveyed such as the specific power disc loading, rotor solidity and blade tip-speed.

56512 **(RISO-M—2697) Economics of wind turbines. Status og perspektiver for vindmoeller opstillet i Danmark.** Morthorst, P.E.; Hjuler Jensen, P. (Risoe National Lab., Roskilde (Denmark)). Nov 1987. 64p. (In Danish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754880/JAW.

The report gives the state-of-the-art of the economics of wind turbines in Denmark. A statistical analysis is performed for windmills already existing in the Danish energy system. Based on real figures for wind produced electricity average economic assessments are carried out for 55 kW, 75 kW and 95 kW wind turbines. New turbines at the market to day are typical of 150-200 kW size. The economics of these wind turbines are calculated and sensitivity analysis on the most important parameters performed. The wind produced electricity will substitute electricity produced at conventional power plants. Given the assumptions for the development of energy prices and environmental regulations an analysis of the costs saved at the power plants are carried out. Finally, a comparison is made between the costs of wind produced electricity and the costs saved at the power plants. 30 tabs., 14 ills.

1706 Wind Energy Engineering

REFER ALSO TO CITATION(S) 56468

56513 **(NEI-FI—16) Research on the use of a small wind power station as the sole source of electric energy in small houses.** Taukojaervi, J. (Tuulitekniikka Ky, Pirkkala (Finland)). Aug 1986. 15p. (In Finnish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754865/JAW.

During the investigations it was observed that in Finland wind energy can be generated with a relatively small capacity accumulator if used for household lighting and home electronic appliances only. The economy of wind energy will depend on other energy sources available as well as the location of the windmill. Windmills made by Tuulitekniikka Ky are located in Kontiolahti, Kotka and in the archipelago near Uusikaupunki. The last one has been the test site. A windmill with vanes of 7 metres in diameter and a capacity of 7 to 10 kw costs about 100.000-120.000 Finnish marks to build. The cost is mainly due to labor costs when the mills are made one by one or few at a time. As a do-it-yourself project one can make a simple windmill for heating purposes only for about 25.000 Finnish marks. One can buy a ready made windmill with a capacity of 3000 kwh at a price of 100.000 Finnish marks. It will probably last for fifteen years and thus one kwh will cost about 2.2 Finnish marks. The windmill in Kontiolahti has by now produced electricity for 4.5 years without any repairs. Due to the absence of an electricity meter no exact production figures can be given but the estimate is about 3000 kwh per year. Assuming that the price of energy is 0.30 marks per kwh the mill has so far yielded a profit of 4000 Finnish marks.

56514 **(NRC/E—TM-WE-008) An Apple II program for computing windmill performance.** Templin, R.J. (National Research Council of Canada, Ottawa, Ontario. Div. of Energy). Jan 1982. 12p. (CE—01796). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This memorandum describes a BASIC program for the Apple II computer, which computes windmill performance as a function of seven input variables: average wind speed, the exponent in the Weibull probability distribution of wind speed, air density, a windmill figure of merit, rotor swept area, installed maximum power, and cut-out wind speed, annual energy produced (assuming 100% availablility of the windmill), cut-in wind speed, annual number of operating hours (at 100% availability), and power loading coefficient that is useful in judging whether the windmill power is well matched to the specified wind conditions. As with any method of computing average windmill output, the results must be considered to be approximate only, owing partly to their sensitivity to some of the input quantities (such as average wind speed and estimated figure of merit), and also in the present case to an assumption made about the shape of the curve of instantanous power versus instantaneous wind speed. Appendices list an Apple II program and sample results. 1 ref., 1 fig.

56515 **(RISO-M—2727) Investigations of aerodynamics, structural dynamics and fatigue on Danwin 180 kW.** Rasmussen, F.; Petersen, S.M.; Larsen, G.; Kretz, A.; Andersen, P.D. (Risoe National Lab., Roskilde (Denmark)). Jun 1988. 122p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88754884/JAW.

A comprehensive measurement programme has been carried through on a Danwin 180 kW wind turbine erected at The Test Station for Windmills. This report deals with investigations of aerodynamics, structural dynamics and fatigue performed in relation to these measurements. The main topics of the report are 1) the aerodynamic load distribution along the blade, 2) the dynamics of the turbine as studied by measurements and by a model based on the finite-element methods, 3) separation of the measured loads in deterministic and stochastic parts, and 4) measuring load spectra by rainflow counting and estimating fatigue lifetime using these spectra and the Palmgreen-Miner fatigue damage law: Another aim of the work has been to support the verification of a Danish construction code for wind turbines. Load spectra are measured for some of the main load signals. These are the tower root bending axially and transverse, tower torsion and blade root bending, flapwise and edgewise. The range distributions are determined as 10 min averages as function of wind speed and turbulence. These spectra are used to estimate the 20 years of operation load spectra which are used for fatigue analysis. The results are compared to the existing code of practice in wind turbine design. It appears that the tower loads especially are rather conservative in the existing codes. 3 tabs., 94 ills., 16 refs.

56516 **(SAND—88-0541C) Liquid crystals for surface shear stress visualization on wind turbine airfoils.** Reda, D.C.; Smith, R.W.; Bryant, T.C.; Schluter, L.L. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 11p. (CONF-880916—1). NTIS, PC A03/MF A01. Order Number DE88017117/JAW.

From 18. national conference of the American Wind Energy Association; Honolulu, HI, USA (19 Sep 1988).

Experiments were conducted on the Sandia 17-m vertical axis wind turbine to test the liquid-crystal/surface-shear-stress visualization technique in field environments. A Sandia natural-laminar-flow airfoil served as the test surface. Initial feasibility experiments were conducted under high-tip-speed-ratio, high-Reynolds-number conditions, which resulted in low angle-of-attack, quasi-steady flow fields. Data acquisition was accomplished with a tower-mounted

movie camera and 35mm color film. Liquid crystal coatings sensitive only to surface shear stress, and insensitive to temperature changes for temperatures below 50{degree}C, were utilized. Observations of coating color changes showed the liquid crystal technique capable of visualizing surface shear stress distributions, including (by contrast) regions of separated flow, under field-test conditions. 10 refs., 3 figs.

56517 (SL—83148-50) Power measurements on 45 kW NORDTANK wind turbine with turbotape sited at Faaborg/Funen. Paulsen, U.S.; Bjerregaard, E. (Skibsteknisk Laboratorium, Lyngby (Denmark)). Jan 1984. 22p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754885/JAW.

This report contains results of measurements carried out on a 3-bladed, 45 kW HAWT wind turbine, which is operating in parallel with the electrical grid. The FYNSVINGEN rotor is manufactured by DANROTOR. Tape has been glued on the airfoil near the leading edge in order to induce turbulence at the profile section. The wind turbine is sited near Faaborg, South Funen. The measurements are accomplished with the mobile field test station developed at the Danish Maritime Institute. The test programme performed has given information on: - the electrical power output from the wind turbine as a function of the wind speed at hub-height; - the total efficiency of the wind turbine as a function of the wind speed at hub-height; - the annual energy production of the wind turbine in operation under different wind conditions. Full availability is assumed. The power curve of the HAWT with turtotape indicate a significant turbulence effect in a narrow wind speed interval. A stall region with power level of 23 kW is measured at wind speeds between 9 m/s and 12 m/s. At higher wind speeds than 12 m/s the power output is increasing with increasing wind speed indicating the lack of stall. The measurements have been carried out for: The Test Station for Minor Windmills, Risoe National Laboratory. The measurement techniques are following the IEA recommendations: Power performance testing, Ref. 1. The presentation of measuring equipment, analysis techniques and time histories for the test period is given in Ref. 3.

56518 (STADIA—9002088) Wind turbine worldwide catalog 1988-89. Jaras, T.F. (ed.). (Stadia, Inc., Great Falls, VA (USA)). [1988]. 172p. Unlimited audience, publicly available. Circulation Department Stadia, Inc., P.O. Box 442, Great Falls, Virginia 22066. Order Number TI89002088/JAW.

The information presented in this catalog was collected from wind turbine manufacturers between April and July 1988 using a standard survey form. Most companies were also contacted by telephone to discuss the details of their submissions. In 1986, a similar survey was conducted and included as an appendix to Wind Energy 1987: Wind Turbine Shipments and Applications. This was the first in a series of annual wind industry market information publications prepared by the Wind Data Center. A large audience exhibited interest in having this comprehensive listing of manufacturers and products as a separate publication. As this young and dynamic industry continues to grow and the market becomes truly worldwide, a product catalog becomes an essential tool for planners and decision makers, prospective customers, and the wind industry membership.

20 ELECTRIC POWER ENGINEERING

56519 (HQ—8703) Hydro-Quebec Research Institute activity report, 1986. (Hydro-Quebec, Montreal (Canada)). Mar 1987. 110p. (In English and French). (MICROLOG—88-04192). Institut de recherche d'Hydro-Quebec, 1800, montee Sainte-Julie, Varennes, P.Q., Canada J0L 2P0; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Hydro-Quebec Research Institute is active in various fields of electrical energy research, development, and commercialization. This report outlines the year's activities of this organization in the areas of generation, transmission and distribution, industrial applications, testing/measuring, new facilities, marketing, international activities, and cooperation with universities. Much of the research and development activity is intended to improve the operations of Hydro-Quebec and to increase the market for electric power. Research and development is also done for outside organizations inside Canada and around the world.

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 56169, 56387, 56683, 56773, 56792, 56872, 57155, 57257

56520 (CREIC—8601, pp 2) Electricity generation by biomass gasification. Drouin, G. (Biodev International, Inc., Montreal, Que.). 1986. CANMET; $0.34CAN per page, $3.40 CAN minimum. (CONF-860124—; CE—01913).

From New energy sources: challenges and business opportunities; Toronto, Ontario, Canada (26 Jan 1986).

A biomass power plant, using gas generated by a fluidized bed reactor to power a dual-fuel diesel engine, has been developed and is operating in French Guiana. Feedstock consists of such wastes as coconut shells, peanut husks, and damaged trees. 1 kg of dry biomass produces 1.3-1.5 kW at the alternator terminals using a power-generating unit with 36% efficiency, and 0.9-1 kW using a steam turbine boiler system.

56521 (DOE/PC/72571—T12) Market and equipment performance analysis for the application of coal-based fuels/advanced combustion systems: Commercial and small industrial applications: Volume B, Appendices. (Burns and Roe, Inc., Oradell, NJ (USA)). May 1986. Contract AC22-84PC72571. 272p. NTIS, PC A12. Order Number DE87013671/JAW.

In March 1985, Burns and Roe Services Corporation (BRSC) under Contract No. AC22-84PC72571 with the US Department of Energy, Pittsburgh Energy Technology Center (DOE/PETC) initiated a task entitled "Market and Equipment Performance Analysis for the Application of Coal-Based Fuels/Advanced Combustion Systems." This volume contains the following Appendices: Commercial sector applications of coal based fuels and advanced technologies, EOS Technologies, Inc.; Estimation of fuel use and population for industrial boilers <50 mm Btu/hr and direct fired combustors <100 mm Btu/hr firing oil and gas, PEI Associates; Characteristics of oil and gas fired boilers; Characteristics of oil and gas fired process heaters; Environmental permitting considerations; States air emission rules and regulations applying to commercial/industrial boilers and process heaters <100 mm Btu/hr heat input; Advanced coal combustion systems; Application of advanced coal combustion systems to watertube boilers; Application of advanced coal combustion systems to firetube boilers; and Application of advanced coal combustion systems to process heaters.

56522 (EPRI-AP—5950-Vol.2) An evaluaton of integrated-gasification-combined-cycle and pulverized-coal-fired steam plants: Volume 2, Sensitivity studies and appendixes: Final report. Pietruszkiewicz, J.; Milkavich, R.J.; Booras, G.S.; Thomas, G.O.; Doss, H. (EG and G Idaho, Inc., Idaho Falls (USA); Bechtel Group, Inc., San Francisco, CA (USA)). Sep 1988. 301p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89000291/JAW.

The Electric Power Research Institute contracted with Bechtel Group, Inc., to provide an evaluation of the performance and costs for a Texaco-based integrated gasification combined cycle (IGCC) power plant as compared to a conventional pulverized coal-fired steam (PCFS) power plant with flue gas desulfurization (FGD). A general set of groundrules was used within which each plant design was optimized. The study incorporated numerous sensitivity cases along with up-to-date operating and cost data obtained through participation of equipment vendors and process developers. Consequently, the IGCC designs presented in this study use the most recent data available from Texaco's ongoing international coal gasification development program and General Electric's continuing gas turbine development efforts. The study confirms that the Texaco-based IGCC has advantages over the conventional PCFS technology with regard to environmental emissions and natural resource requirements. SO_2, NOx, and particulate emissions are lower. Land area and water requirements are less for IGCC con-

cepts. In addition, coal consumption is less due to the higher plant thermal efficiency attainable in the IGCC plant. The IGCC plant also has the capability to be designed in several different configurations, with and without the use of natural gas or oil as a backup fuel. This capability may prove to be particularly advantageous in certain utility planning and operation scenarios.

56523 **(EPRI-CS—6014) Condenser leak-detection guidelines using sulfur hexafluoride as a tracer gas: Final report.** Hollis, R.; Tondi, D. (Electric Power Research Inst., Palo Alto, CA (USA); Science Applications International Corp., Rockville, MD (USA)). Sep 1988. 99p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89000249/JAW.

The procedures and information contained in this report detail the equipment and technique required to perform a main surface condenser leak inspection using SF_6. They provide generating station leak-test personnel, responsible for conducting the tests, with the fundamentals for condenser air leakage and on-line tube-leaking testing (water box isolation). Specific topics discussed in the report include differentiating between multiple leak paths, integrating the techniques to specific plant configurations, selecting off-gas sampling points, and selecting SF_6 injection points for on-line tube-leak testing. The information contained in the report results from four years of service experience with the SF_6 technique and EPRI sponsored generation and "in-plant" evaluation of the leak test procedures. 25 figs.

56524 **(GERAD—G-85-25) Electricity production technologies around the world and in Quebec.** Savard, G. (GERAD Ecole des Hautes Etudes Commerciales, Montreal, Quebec (Canada)). Dec 1985. 147p. (In French). (CE—01946). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

MARKAL-QUEBEC is a linear programming model whose purpose is to optimize the evolution of the means of production, transformation and utilization of divese forms of energy in order to satisfy the various kinds of external demands. This report has the objective of presenting the electricity production technologies included in the MARKAL-QUEBEC data bank. It presents the principal parameters and characteristics, techniques and economics, of these technologies, so as to be useful to modelers using MARKAL-QUEBEC. In order to understand the present situation, the evolution of the demand and production of elecricity around the world and in Quebec is presented. Specific chapters are devoted to non-renewable, nuclear, and renewable technologies; for each technology presented, an overview of the world situation is given, followed by the general principles of the technology and a summary of technical and economic data. Technologies of storage and peak management are also included. The particular situation of Quebec's electricity sector is described to determine the technologies included in the data bank, and tables are included for use in the MARKAL-QUEBEC model. 91 refs., 5 figs., 48 tabs.

56525 **(ORNL/Sub—87-86004/4) Energy Economic Data Base (EEDB) program: Phase 9 update (1987) report, AHS5-AF supplement.** (Oak Ridge National Lab., TN (USA); United Engineers and Constructors, Inc., Philadelphia, PA (USA)). Sep 1988. Contract AC05-84OR21400. 233p. NTIS, PC A11. Order Number TI89001143/JAW.

The purpose of this AHS5-AF supplement is to identify direct equipment, material, and labor costs and indirect costs in sufficient detail to be used as a baseline for comparing the costs of atmospheric fluidized bed coal-fired power plants with the costs of alternatives. This information is needed to satisfy the cost evaluation requirements of the US Department of Energy (DOE), Energy Information Administration (EIA), Office of Coal, Nuclear Electric and Alternate Fuels, Data Analysis and Forecasting Group. The objective of the data base is to develop credible cost estimates that clearly indicated what is included in the costs. This objective is achieved through the development of summary and detailed technical/cost data models, clear statements of the ground rules and assumptions on which the technical and costs detail is based, and assembly and presentation of data in accordance with a uniform code-of-accounts. Additionally, the data models are periodically and extensively aligned with actual power plant technical practice and cost experience. Because of the consistent EEDB approach, the ground rules, the code-of-accounts and the periodic alignments, the EEDB user may have confidence that the various alternatives contained in the data base are highly comparable, internally consistent, and representative of current experience. 12 refs., 14 figs., 19 tabs.

2002 Environmental Control Technology

REFER ALSO TO CITATION(S) 56012, 56035, 56037, 56406, 56420, 57266, 57526, 57527, 57528, 57529, 57612

56526 **(AD-A—195220/9/XAB) Compliance testing of Grissom AFB central-heating-plant coal-fired boilers 3 and 4, Grissom AFB Indiana. Final report, 18-23 November 1987.** Garrison, J.A. (Air Force Occupational and Environmental Health Lab., Brooks AFB, TX (USA)). Mar 1988. 151p. (USAFOEHL—88-050EQ0025CEF). NTIS, PC A08/MF A01.

At the request of HQ SAC/SGPB, compliance testing (particulate emissions) of coal-fired boilers 3 and 4 in the Grissom AFB central heating plant was performed on 18-23 Nov 1987. The survey was conducted to determine compliance with Indiana Administrative Code, Title 325--Air Pollution Control Board, Articles 5 and 6. Results indicate Boiler 3 met particulate standards while exhausting through the bypass stack, but failed to meet standards when exhausting through the scrubber stack. Boiler 4 met particulate standards when exhausting through both the bypass the scrubber stacks.

56527 **(DOE/PC/60259—T74-Vol.2) Ebara electron-beam flue gas treatment process: Indianapolis, Indiana, demonstration unit: Final report: Volume 2, Appendix.** (Ebara International Corp., Greensburg, PA (USA); Avco-Everett Research Lab., Everett, MA (USA)). Jun 1988. Contract AC22-83PC60259. 276p. NTIS, PC A13/MF A01. Order Number DE88014533/JAW.

The volume contains the appendicies for Volume I of the final report. The appendicies listed herein correspond to the sections in the text from which they were referenced: AVCO computer code; description of baghouses and electrostatic precipitators; methods for determination of sulfur oxides in flue gas; methods for determination of ammonia in exhaust gas; determination of nitrous oxide emissions; determination of particle size; methods of measuring dust content in flue gas; electron beam power loss in irradiation of process vessel gases; log data tables.

56528 (EPRI-CS/EA/AP—5663-SR, pp 2.51-2.65) **Full-scale operational demonstration of fine mesh screens at power plant intakes.** Brueggemeyer, V.; Cowdrick, D.; Durrell, K.; Mahadevan, S.; Bruzek, D. (Tampa Electric Company, FL (USA)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920262/JAW. (CONF-8710303—).

From Fish protection at steam and hydroelectric power plants; San Francisco, CA, USA (28 Oct 1987).

Tampa Electric Company (TEC) operates four coal-fired generating units at the Big Bend Station located on Tampa Bay in North Ruskin, Florida. All four units use once-through condenser cooling systems. Prior to the construction of Big Bend Unit 4, environmental agencies expressed concern over entrainment of organisms. Engineering and biological studies conducted in 1980 indicated that the application of fine mesh screens (FMS) at the station would reduce entrainment levels. As a result of this, the environmental agencies authorized the use of a once-through condenser cooling system in Unit 4 with the installation of FMS (0.5 mm) on both Units 3 and 4. In conducting required post-operational (February 1985) studies to verify expected screening efficiencies, TEC identified that sampling methodologies, and the nature and extent of operational and maintenance procedures were critical in achieving good screening efficiencies. This paper summarizes TEC efforts in ascertaining adequate screening efficiencies.

56529 (PB—88-231105/XAB) Modification of the PPSP (Power Plant Research Program) dispersion model for highly buoyant plumes. Weil, J.C.; Corio, L.A. (Versar, Inc., Columbia, MD (USA)). Jun 1988. 56p. NTIS, PC A04/MF A01.

The report describes a modification of the PPSP dispersion model for tall stack plumes. The modification accounts for the dispersion of highly buoyant plumes that loft or remain near the top of the convective boundary layer and resist downward mixing. The main idea is that plume segments are mixed to the ground only by downdrafts with sufficient kinetic energy to overcome the potential energy difference between the plume and the ambient air. Simple analytical expressions are derived for the crosswind-integrated concentration and the ground-level concentration (GLC). They are based on the conservation of plume buoyancy, the probability distribution of the ambient vertical velocities, and the lateral plume spread. Evaluation of the modified model with GLCs around power plant stacks shows that it performs better than the original model.

56530 (PB—88-233903/XAB) Growth and metal uptake of the plant Cyperus esculentus and the worm Eisenia fetida in a worst-case experiment on coal fly ash and Rhine sediment. Marquenie, J.M.; Crawley, D.K.; de Jong, P.; Jenner, H.A. (Keuring van Electrotechnische Materialen N.V., Arnhem (Netherlands)). 1988. 13p. NTIS, PC E03/MF A01.

Summary in Japanese. See also PB—88-150834.

The rapidly growing amount of non-reusable fly ash from coal-fired power stations leads to growing concern about long-term environmental effects. This concern is focused on the total of elevated-metal concentrations in fly ash and not on the bioavailability. Attention is therefore particularly devoted to destruction and measurement techniques. The substrates used are a well-known fly ash, Rhine sediment as a contaminated comparable sediment, and a clean sediment from a sand-digging pit. The results indicate that the conclusion that fly ash is a toxic-waste product is not correct a priori. Earthworms did not show signs of added toxicity after 32 days in 100% fly ash. The use of total-metal concentrations for predicting the environmental hazard of fly ash is not realistic if one takes into account the concentrations which are available for the biota, even if the results of such biotests that involve plants and/or worms are difficult to compare.

2003 Power Transmission And Distribution

REFER ALSO TO CITATION(S) 56389, 56390, 58309

56531 (EFI-TR—3477) Eolian vibration in power lines. Ervik, M. (Elektrisitetsforsyningens Forskningsinstitutt, Trondheim (Norway)). Dec 1987. 47p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754854/JAW.

The report gives an overview of the theoretical treatment of vibrations in electric power lines. The risk of damage is seen in relation to the level of vibration. Various ways of expressing this level are given, The energy balance principle is explained, and it is shown how this can be used to find the level of vibration in laminar wind. The effect of the turbulence of the wind is briefly explained. A theoretical model to compute the effect of a damping system, by the use of the energy balance principle is explained, and it is shown how this can be used to find the level of vibration in laminar wind. The effect of the turbulence of the wind is briefly explained. A theoretical model to compute the effect of a damping system, by the use of the energy balance principle, is mentioned and an example of its application is shown. 21 refs., 13 figs.

56532 (HQ—8707) Reduction of audible noise of high voltage transmission lines. (Hydro-Quebec, Montreal (Canada)). Jul 1981. 180p. (CE—01789). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Tests were performed on single conductors to identify the elements that affect their corona performance under rain. Three types of improved conductors were considered. Hydrophobic conductors with improved performance are difficult to manufacture, would have short durability and would offer small performance improvements at surface fields below 13.5 kV/cm. Hydrophilic conductors can be easily obtained but are not, in a simple version, superior to naturally-aged conductors. To obtain further performance improvements geometrical surface modifications based on capillarity must be made. The super hydrophilic conductors thus obtained will excel at low to moderate field values (10-15 kV rms/cm). The only method of corona effects reduction that is effective at high electric field intensities is the ion-shield, which consists of ions generated by glow discharges and obtained by fine conductive fibers deposited on an otherwise normal conductor. The fibers successfully attenuate interference under rain, but unduly increase fair weather power losses. This problem can be solved by using fine cotton threads in the form of cotton cloth as a conductor covering. Under rain, when wetter, the fiber generates glow discharges which improve conductor performance. The report also examines the question of bundle optimization by asymmetrical repartition of conductors on the bundle. An improved calculation method was developed which suggests that gains can be attained by this method. Includes suject index. 133 refs., 47 figs., 2 tabs.

56533 (UPTEC—8725R) Optimal feedforward power-frequency control for hydro power stations in interconnected systems. Milocco, R.H.; Sternad, M. (Laboratorio Control Automatico, La Plata (AR); Uppsala Univ. (SE)). (Uppsala Univ. (Sweden). Inst. of Tech.). Feb 1987. 49p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755117/JAW.

Load feedforward is discussed as a method for improving power frequency control. The discussion is based on a model of the Argentinian Interconnected System. Only hydro power stations are suitable for frequency control in this system. The design of load feedforward filters acting on hydro stations is nontrivial for several reasons. The system is non-minimum phase. The input is rate-limited. The design must be robust with respect to load variations which affect the linearized dynamics. A method for calculating optimal feedforward filters for non-minimum phase systems is presented. It is based on a polynomial LQG approach. Compared with frequency feedback control only, such filters are found to reduce the power frequency standard deviation by 25-60% in a simulation study. The response to load changes is improved markedly. The design is insensitive to load variations. (authors).

56534 Electron emitting filaments for electron discharge devices. Leung, K.N.; Pincosy, P.A.; Ehlers, K.W. (to Dept. of Energy, Washington, DC). US Patent 4,760,306. 26 Jul 1988. Filed date 10 Jun 1983. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

An electron emitting device is described for use in an electron discharge system comprising: a filament having a pair of terminal ends, electrical supply means for supplying electrical power to the terminal ends of the filament for directly heating the filament by the passage of an electrical current along the filament between the terminal ends, the filament being substantially tapered in cross section continuously in one direction from one of its pair of terminal ends to another of its pair of terminal ends to achieve uniform heating of the filament along the length thereof by compensating for the nonuniform current along the filament due to the emission of electrons therefrom.

21 NUCLEAR POWER PLANTS

REFER ALSO TO CITATION(S) 56221, 56222, 56223, 56224, 56637, 56744, 56745, 58230

56535 (DOE/OSTI—8200-R51) Nuclear reactors built, being built, or planned: 1987. (USDOE Office of Scientific and Technical Information, Oak Ridge, TN). Jun 1988. 65p. NTIS, PC A04/MF A01. Order Number DE88010420/JAW.

Nuclear Reactors Built, Being Built, or Planned contains unclassified information about facilities built, being built, or planned in the United States for domestic use or export as of December 31,

1987. The Office of Scientific and Technical Information, US Department of Energy, gathers this information annually for Washington headquarters and field offices of DOE; from the US Nuclear regulatory Commission; from the US reactor manufacturers who are the principal nuclear contractors for foreign reactor locations; from US and foreign embassies; and from foreign governmental nuclear departments. The major change in this revision involves the data related to shutdown and dismantled facilities. Because this information serves substantially different purposes, it has been accumulated in a separate section, "Reactors and Facilities Shutdown or Dismantled." Cancelled reactors or reactors whose progress has been terminated at some stage before operation are included in this section.

56536 (INIS-mf—11310, pp 30) **Net power - and net energy yield from german nuclear power plants.** Hohenwarter, D.; Heindler, M. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

56537 (INIS-mf—11310, pp 49) **ESA - a computer code to analyze nuclear power systems.** Hinterkircher, M.; Weger, I. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

56538 (NUREG—0020-Vol.12-No.8) **Licensed operating reactors: Status summary report, data as of 07-31-88.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Administration and Resources Management). Sep 1988. 485p. NTIS, PC A21/MF A01 - GPO. Order Number TI89000488/JAW.

The US Nuclear Regulatory Commission's monthly LICENSED OPERATING REACTORS Status Summary Report provides data on the operation of nuclear units as timely and accurately as possible. This information is collected by the Office of Information Resources Management, from the Headquarters Staff of NRC's Office of Inspection and Enforcement, from NRC's Regional Offices, and from utilities. Since all of the data concerning operation of the units is provided by the utility operators less than two weeks after the end of the month, necessary corrections to published information are shown on the ERRATA page. This report is divided into three sections: the first contains monthly highlights and statistics for commercial operating units, and errata from previously reported data; the second is a compilation of detailed information on each unit, provided by NRC Regional Offices, IE Headquarters and the Utilities; and the third section is an appendix for miscellaneous information such as spent fuel storage capability, reactor years of experience and non-power reactors in the United States.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 56212, 56214, 56232, 56572, 56601, 56608, 56620, 56628, 56630, 56631, 56645, 56665, 56674, 56678, 56686, 57147, 57148, 57149, 57150, 57151

56539 (CONF-8810155—1) **Evaluation of aged concrete structures for continued service in nuclear power plants.** Naus, D.J.; Marchbanks, M.F.; Arndt, E.G. (Oak Ridge National Lab., TN (USA); Nuclear Regulatory Commission, Washington, DC (USA)). 1988. Contract AC05-84OR21400. 19p. NTIS, PC A03/MF A01. Order Number DE88016364/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

Results are summarized of a study on concrete component aging and its significance relative to continued service of nuclear power plants (NPPs) beyond the initial period for which they were granted operating licenses. Progress is presented of a second study being conducted to identify and provide acceptance criteria for structural safety issues which the USNRC staff will need to address when applications are submitted for continued service of NPPs. Major activities under this program include: development of a materials property data base, establishment of structural component assessment and repair procedures, and development of a methodology for determination of structural reliability. 19 refs., 5 figs., 3 tabs.

56540 (DOE/ID/12647—2-Vol.1) **Final design report for the Prototypical Consolidation Demonstration Project (Engineering Materials): Phase 2.** (Nutech Engineers, Inc., San Jose, CA (USA)). Dec 1987. Contract AC07-86ID12647. 555p. (DOE—22-199-Vol.1). NTIS, PC A24/MF A01. Order Number TI89000674/JAW.

This report documents NUTECH's final design of a dry, spent fuel rod consolidation system. The scope of Phase 2 of the PCDP has resulted in a final design, plus all of the engineering documentation required to demonstrate that the specified design requirements for the system are satisfied by that design. All the details of NUTECH's final design are described in this PCDP Phase 2 final design report. Compliance with the generic functional requirements, the TAN-specific functional requirements, and all applicable codes and standards is documented in this report. Detailed descriptions are provided of all consolidation equipment and support systems, plus the remote operations and maintenance systems. The equipment and operational systems required for decontamination and radioactive waste management, as well as the other facility and operating requirements are discussed in this report. Reference CAPE-3008, 3009, 3010, 3011, and 3012.

56541 (EPRI-NP—4946-SR) **BWR normal water chemistry guidelines: 1986 revision.** (Electric Power Research Inst., Palo Alto, CA (USA)). Sep 1988. 96p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89000245/JAW.

Boiling water reactors (BWRs) have experienced stress corrosion cracking in the reactor cooling system piping resulting in adverse impacts on plant availability and personnel radiation exposure. The BWR Owners Group and EPRI have sponsored a major research and development program to provide remedies for this stress corrosion cracking problem. This work shows that the likelihood of cracking depends on the plant's water chemistry performance (environment) as well as on material condition and stress level. Plant experience and other research demonstrate that water quality also affects fuel performance and radiation field buildup in BWRs. This report,"BWR Normal Water Chemistry Guidelines: 1986 Revision," presents suggested generic water chemistry specifications, justifies the proposed water chemistry limits, suggests responses to out-of-specification water chemistry, discusses available chemical analysis methods as well as data management and surveillance schemes, and details the management philosophy required to successfully implement a water chemistry control program. An appendix contains recommendations for water quality of auxiliary systems. 73 refs., 20 figs., 9 tabs.

56542 (EPRI-NP—6034) **An assessment of NRC Regulatory Guide 1.150: Revision 1, Implementation and interpretation: Final report.** Cowfer, C.D. (Electric Power Research Inst., Palo Alto, CA (USA); Southwest Research Inst., San Antonio, TX (USA)). Oct 1988. 77p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89001592/JAW.

The Introduction of this report provides background on the historical perspective of Nuclear Regulatory Commission (NRC) Regulatory Guide (RG) 1.150, the need for this study, and a summary of the conclusions and recommendations. Section 2, Criteria for Performance of an Acceptable Vessel Examination in Today's Regulatory Climate, is intended to provide an overview of pressures acting on the inservice inspection (ISI) cognizant owner individual who is trying to do an "acceptable vessel examination" based on Code rules: licensing requirements; and a host of regulatory requirements, one if which is RG 1.150. Section 3, Conclusions and Recommendations, provides a summary of significant findings in the study and all recommendations that should be considered by the Electric Power Research Institute (EPRI), NRC, and interested owners. Section 4 contains the questionnaire prepared for this study and answers, inserted appropriately, that provided the basis for the

conclusions and recommendations. In Section 5, the content of Revision 1 is given in its entirety with Rev. 2 proposed changes noted adjacent to the corresponding related section. Section 6 presents a proposed Appendix B, also to be considered for Rev. 2 to RG 1.150. Section 7, presented in a tabular format, gives, first, a listing of Code rules prior to RG 1.150 publication; second, RG 1.150 "Concerns" found in its Appendix A (1982); then, finally Code rules published or pending after RG publication (1982). The presentation shows how most questions about RG 1.150, except performance demonstration, are already addressed in published Code rules. The purpose of Section 7 is to justify eventual rescinding of RG 1.150 by NRC. Section 8 provides technical justification for each change proposed in Section 5; Section 9 addresses implementation RG 1.150 after Revision 2 is published, and Section 10 lists the utilities and plants that participated in the study.

56543 **(IKE—6-173) Dynamic behavior of BWR's with positive void coefficient according to a point model.** Lukas, B.; Emendoerfer, D. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme). Oct 1987. 53p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755161/JAW.

With a grid spacing of the pressure tubes of 25 cm, the fission zone of the RBMK-1000 pressure tube BWR is overmoderated because of the large quantity of graphite. The coolant in the pressure tubes acts mainly as absorber, not as moderator. An increase in the steam volume also increases the neutron multiplication factor: The void coefficient of reactivity is positive. Without control, there is therefore a positive power amplification in the RBMK-1000, which, in spite of the negative Doppler coefficient, can lead to high power peaks. In our water-moderated BWR's the neutron multiplication factor decreases with increasing steam volume, in contrast to the RBMK-1000. The void coefficient of reactivity is always negative on the BWR-1300 and, apart from the Doppler coefficient, contributes considerably to the self-stabilisation on power increase. The time behaviour of uncontrolled graphite-moderated pressure tube BWR's is examined here as a consequence of changes of throughput at part load and full load for various void coefficients. Point models are used for neutronics and thermo-hydraulics, for simplicity's sake. Local power distribution instabilities cannot, of course, be included in this model.

56544 **(OEFZS—4445) Calculation of a leak in the bottom of a bwr-pressure vessel using THYDE-B1.** Nathschlaeger, P. (Oesterreichisches Forschungszemtrum Seibersdorf G.m.b.H. Inst. fuer Energie- und Anlagentechnik). (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Apr 1988. 25p. (In German). (EA—315/88). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704056/JAW.

The present report describes the modelling of a boiling water reactor of the Gemeinschaftskraftwerk Tullnerfeld (GKT) plant type. The corresponding input data set for the Japanese computer code THYDE-B1 allows the simulation of the thermohydraulic transient within the reactor coolant system during a loss of coolant accident. The initiating event 'Leak in the Reactor Pressure Vessel Bottom' has been calculated as an application exercise. The results are discussed using graphic representation, where one should be aware that the calculated data do not correspond with any specific plant configuration of the boiling water reactor generic design. 1 ref., 7 figs.

56545 **(PNL—6630) Comparison of HYDRA-II predictions to temperature data from consolidated and unconsolidated model spent fuel assemblies.** McCann, R.A. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 46p. NTIS, PC A03/MF A01. Order Number DE89001171/JAW.

Using the HYDRA-II computer code, Pacific Northwest Laboratory (PNL) researchers analyzed the thermal performance of two model spent fuel assemblies. The numerical simulations were based on information from offsite laboratory tests conducted previously on an unconsolidated and a consolidated rod assembly. The objectives of the PNL effort were to examine the thermal characteristics of the consolidated rod assembly and to validate the predictive capability of the HYDRA-II code for application to such analyses. When compared to the physical test data, the predictions generated by HYDRA-II were in excellent agreement for all temperature comparisons. These analyses provided further validation of HYDRA-II's capability to accurately predict thermal performance of spent fuel storage system components. Results obtained for the consolidated rod assembly lend strong support to the value of further investigations of this option for dry storage of spent fuel. 14 refs., 10 figs., 7 tabs.

56546 **(SAND—88-2282C) Analyses of Mark I drywell shell melt-through.** Weingardt, J.J.; Bergeron, K.D. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 36p. (CONF-881169—1). NTIS, PC A03/MF A01. Order Number DE88016343/JAW.

From American Nuclear Society winter meeting; Washington, DC, USA (1 Nov 1988).

A series of parametric calculations of the thermal attack of molten corium on a steel shell have been performed with the TAC2D computer code in order to elucidate uncertainties about the survivability of the BWR Mark I containment boundary in the event of a core-melt accident. Since TAC2D is a two-dimensional, fixed geometry heat transfer code, it is not possible to capture some of the complexities of the debris-concrete interactions which would occur in this accident. However, the two-dimensional transient nature of the thermal attack is modeled better with TAC2D than is possible with existing debris-concrete interaction codes. The calculations consist of two base cases (one with overlying water and one without) and numerous sensitivity variations about each case. The study is not intended as an uncertainty assessment per se. Rather,it is intended that the results can be combined with assessments of the parameter ranges to assist in the estimation of overall uncertainty about the drywell shell melt-through issue. Sensitivities investigated include mixed versus layered debris, heat transfer parameters, initial corium temperature, chemical heating rate, heat transfer conditions in the gap outside the shell, and corium depth. All but two of the cases resulted in ablation and melt-through of the shell in times that ranged from 8.3 minutes to 75.8 minutes. The two cases that did not melt both involved the mixed debris assumption and enhanced boiling heat transfer to an overlying water pool. 13 refs., 14 figs., 3 tabs.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 56212, 56232, 56539, 56540, 56542, 56572, 56599, 56600, 56602, 56604, 56621, 56622, 56625, 56628, 56630, 56635, 56638, 56641, 56643, 56649, 56665, 56668, 56669, 56674, 56675, 56676, 56678, 56681, 56685, 56686, 56688, 56690, 56909, 57147, 57148, 57149, 57150, 57151, 58310

56547 **(EPRI-NP—5971-Vol.1) 1987 EPRI workshop on secondary-side intergranular corrosion mechanisms: Volume 1: Proceedings.** Partridge, M.J. (Electric Power Research Inst., Palo Alto, CA (USA); Dominion Engineering, Inc., McLean, VA (USA)). Sep 1988. 66p. (CONF-8704323—Vol.1). Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89000443/JAW.

From EPRI workshop on mechanisms of primary water intergranular stress corrosion cracking; Alexandria, VA, USA (29 Apr 1987).

A meeting on "Secondary Side Intergranular Corrosion Mechanisms" was organized in an effort to give those working in this area an opportunity to share their results, ideas and plans. Topics discussed included: (1) caustic induced intergranular attack/intergranular stress corrosion cracking (IGA/IGSCC), (2) mechanisms of inhibition of caustic induced IGA/IGSCC, and (3) alternatives to caustic induced IGA/IGSCC of alloy 600.

56548 **(EPRI-NP—5971-Vol.2) 1987 EPRI workshop on secondary-side intergranular corrosion mechanisms: Volume 2: Proceedings.** Partridge, M.J. (Electric Power Research Inst., Palo Alto, CA (USA); Dominion Engineering, Inc., McLean, VA (USA)). Sep 1988. 671p. (CONF-8704323—Vol.2). Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89000444/JAW.

From EPRI workshop on mechanisms of primary water intergranular stress corrosion cracking; Alexandria, VA, USA (29 Apr 1987).

A meeting on "Secondary Side Intergranular Corrosion Mechanisms" was organized in an effort to give those working in this area an opportunity to share their results, ideas and plans. Topics discussed included: (1) caustic induced intergranular attack/intergranular stress corrosion cracking (IGA/IGSCC), (2) mechanisms of inhibition of caustic induced IGA/IGSCC, and (3) alternatives to caustic induced IGA/IGSCC of alloy 600.

56549 **(IEN-DISER—02/84) Thermohydraulic calculations of PWR primary circuits.** Botelho, D.A. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1984. 41p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703539/JAW.

Some mathematical and numerical models from Retran computer codes aiming to simulate reactor transients, are presented. The equations used for calculating one-dimensional flow are integrated using mathematical methods from Flash code, with steam code to correlate the variables from thermodynamic state. The algorithm obtained was used for calculating a PWR reactor. (E.G.).

56550 **(INIS-BR—1231) Adjustments in Almod3W2 transient analysis code to fit Angra 1 NPP experimental data.** Madeira, A.A.; Camargo, C.T.M. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro). [1988]. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704023/JAW.

Some little modifications were introduced in ALMOD3W2 code, as consequence of the interest in reproducing the full load rejection test in Angra 1 NPP. Such modifications showed to be adequate when code results were compared with experimental data.

56551 **(INIS-BR—1247) Performance of PWR Nuclear power plants, up to 1985.** Muniz, A.A. (ELETROBRAS, Rio de Janeiro (Brazil). Dept. de Estudos Energeticos). 1987. 3p. (In Portuguese). (CONF-8710381—).

From 9. seminar on production and transmission of electric power; Belo Horizonte, Brazil (25 Oct 1987).

The performance of PWR nuclear power plants is studied, based on operational data up to 1985. The availability analysis was made with 793 unit-year and the reliability analysis was made with 5851 unit x month. The results were discussed and the availability of those nuclear power plants were estimated. (E.G.).

56552 (INIS-mf—11311, pp 15) **Model of teledosimetric system for NPP Temelin.** Singer, J.; Koc, J.; Benes, M.; Konecny, J. (Ceskoslovenska Akademie Ved, Prague). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

56553 (INIS-SU—38/A, pp 3-8) **Influence of hydrothermal performance departures on the accuracy of determination of limiting acceptable power of fuel assembly.** Bolonov, E.P.; Slutsker, V.P. 1987. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88780178/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 6.

In Physics and technology of nuclear reactors. Scientific-technical collection.

Estimation of empirical parameters and effects, such as radial mixing influencing maximum permissible fuel power calculation for further experimental investigation planning is conducted.Negligible influence of the accuracy of real void fraction given value and onset of surface boiling on fuel assembly maximum permissible power is determined, while influence of accuracy of lattice local resistance coefficients and friction resistance correction coefficients and on two-phase state is essential. It is determined, that subchannel mixing intensity coefficient is one of the most essential empirical parameters and further investigations of coolant subchannel interaction in rod geometry are necessary. 4 refs.; 4 figs.

56554 **(NUREG/CR—5136) Fatigue strength of smooth and notched specimens of ASME SA 106-B steel in PWR [pressurized water reactor] environments.** Terrell, J.B. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Materials Engineering Associates, Inc., Lanham, MD (USA)). Sep 1988. 91p. (MEA—2289). NTIS, PC A05/MF A01 - GPO. Order Number TI89001019/JAW.

Fatigue strain-life tests were conducted on ASME SA 106-B piping steel base metal and weld metal specimens in 288{degree}C (550{degree}F) pressurized water reactor (PWR) environments as a function of strain amplitude, strain ratio, notch acuity, and cyclic frequency. Notched base metal specimens tested at 0.017 Hz in 1.0 part per billion (ppB) dissolved oxygen environments nearly completely used up the margins of safety of 2 on stress and 20 on cycles incorporated into the ASME Section III design curve for carbon steels, whereas smooth specimen tests from base and weld metal under similar conditions showed considerably less degradation. Tests conducted with specimens having theoretical notch concentration (K/sub t/) values ranging from 2 to 6 showed virtually no effect of notch acuity on fatigue life. Tests conducted with smooth base and weld metal specimens at 1.0 Hz showed virtually no degradation in cycles to failure when compared to 288{degree}C air test results. In all cases, however, the effect of temperature alone reduces the margin of safety offered by the design curve in the low cycle regime for the test specimens. Comparison between the fatigue life results of smooth and notched specimens suggests that fatigue crack initiation is not significantly affected by 1.0 ppB dissolved oxygen, and that most of the observed degradation may be attributed to crack growth acceleration. These results suggest that the ASME Section III methodology should be revised to account for PWR environment variables which degrade fatigue life of pressure-retaining components. 48 refs., 42 figs.

56555 **(NUREG/CR—5185) Steam generator group project: Task 13 final report: Nondestructive examination validation.** Bradley, E.R.; Doctor, P.G.; Ferris, R.H.; Buchanan, J.A. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Pacific Northwest Lab., Richland, WA (USA)). Aug 1988. Contract AC06-76RL01830. 336p. (PNL—6399). NTIS, PC A15/MF A01 - GPO. Order Number TI89001449/JAW.

The Steam Generator Group Project (SGGP) was a multitask effort using the retired-from-service Surry 2A pressurized water reactor steam generator as a test bed to investigate the reliability and effectiveness of in-service nondestructive eddy current (EC) inspection equipment and procedures. The information developed provided the technical basis for recommendations for improved in- service inspection and tube plugging criteria of steam generators. This report describes the results and analysis from Task 13--NDE Validation. The primary objective of Task 13 was to validate the EC inspection to detect and size tube defects. Additional objectives were to assess the nature and severity of tube degradation from all regions of the generator and to measure the remaining integrity of degraded specimens by burst testing. More than 550 specimens were removed from the generator and included in the validation studies. The bases for selecting the specimens and the methods and procedures used for specimen removal from the generator are reported. Results from metallurgical examinations of these specimens are presented and discussed. These examinations include visual inspection of all specimens to locate and identify tube degradation, metallographic examination of selected specimens to establish defect severity and burst testing of selected specimens to establish the remaining integrity of service-degraded tubes. Statistical analysis of the combined metallurgical and EC data to determine the probability of detection (POD) and sizing accuracy are reported along with a discussion of the factors which influenced the EC results. Finally, listings of the metallurgical and corresponding EC data bases are given. 12 refs., 141 figs., 24 tabs.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 56543, 56598, 56605, 56667, 57477

56556 (GA-A—19391) MHTGR [Modular High-Temperature Gas-Cooled Reactor] design and development status. Turner, R.F.; Neylan, A.J. (General Atomics Co., San Diego, CA (USA)). Aug 1988. Contract AC03-88SF17367. 14p. (CONF-880926—1). NTIS, PC A03/MF A01. Order Number DE88015953/JAW.

From Joint power generation conference; Philadelphia, PA, USA (25 Sep 1988).

The Modular High-Temperature Gas-Cooled Reactor (MHTGR) is an advanced power plant concept which has been under design definition since 1984. The design utilizes basic high-temperature gas-cooled reactor features of ceramic fuel, helium coolant and a graphite moderator which have been under development for 30 years. The geometric arrangement of the reactor vessels, the core and the heat removal components has been selected to exploit the inherent characteristics associated with high temperature materials. The design utilizes passively safe features which provide a higher margin of safety and investment protection than current generation reactors. The design has been evaluated to be economically attractive relative to modern coal fired plants. The design and development program is a cooperative effort by the US government, the utilities and the nuclear industry. 8 refs., 4 figs., 4 tabs.

56557 (INIS-mf—11820) Critical evaluation of the experiments and mathematical models for the determination of fission product release from the spherical fuel elements in cases of core heating accidents in modular HTR's. Bailly, H.W. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 5 Jun 1987. 108p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755170/JAW.

In this work, the thermal behaviour of modular reactors in cases of core heating accidents and the physical phenomena relevant for a release of radioactive materials from HTR fuel elements are explained as far as is necessary for understanding the work. The present mathematical models by which the release of radioactive materials from HTR fuel elements due to diffusion or breaking particles in cases of core heating accidents are also described, examined and evaluated with regard to their applicability to module reactors. The experiments used to verify the mathematical models are also evaluated. The mathematical models are in nearly all cases computer programs, which describe the complicated process of releasing radioactive materials quantitative mathematically. One should point out that these models are constantly being developed further, in line with the increasing amount of knowledge. To conclude the work, proposals are made for improving the certainty of information from experiments and mathematical models to determine the release behaviour of modular reactors.

56558 (Juel—2195) Investigation of the hydrogen and tritium impediment of protective coatings on high-alloyed materials of heat exchangers for process heat application. Esser, H.G. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Technische Hochschule Aachen (Germany, F.R.)). Apr 1988. 152p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88755179/JAW.

In High Temperature Reactors, hydrogen permeates at 900/sup 0/C through the walls of the heat exchanger. A research and developing program has been founded in order to reduce the hydrogen permeation by covering the surfaces with oxidic protective layers. This work describes the development, set up and use of a permeation device, which allows by means of permeation technique the direct determination of the quality of the oxidic protection layer deposited on sample plats. The calibration of the device was made with measurements at uncovered samples of nickel and checked by a comparison with literature data. Measurements on uncovered and covered Hastelloy-X-samples are described and discussed theoretically in terms of a two-zone model of the permeation through oxide-substrate layers.

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

REFER ALSO TO CITATION(S) 56623, 56664

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 56208, 56224, 56615, 56617, 56632, 56636

56559 (IAE—4450/4) KURS-2 reactor loop with a molten salt fuel. Part 2. Experimental study of thermal-physical characteristics. Brajko, V.D.; Ignat'ev, V.V.; Novikov, V.M.; Surenkov, A.I.; Tikhomirov, I.B.; Fedulov, V.I.; Cherednikov, V.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1987. 24p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703504/JAW.

The KURS-2 reactor loop represents a vertical closed thermosyphon (CTS) with an insert filled with /sup 7/LiF-BeF/sub 2/-/sup 235/UF/sub 4/ molten salt composition. The lower end of the thermosyphon is placed in the WWR-SM reacor core with the neutron flux up to 0.76x10/sup 14/ cm/sup -2/s/sup -1/. The heat transfer is experimentally investigated at natural convection in the parameter range: the volumetric energy release mean density in a liquid due to nuclear reactions is 1.8-5.6 MW/m/sup 3/, the heat flux through the thermosyphon wall to the liquid in the heating zone is 0-25 kW/m/sup 2/, and the thermosyphon wall mean temperature differences are 65-160 deg C. The generalized dependence characterizing heat transfer in the heating zone of volume heat sources in a liquid and the heat flux through the wall, is obtained. 15 refs.; 14 figs.; 3 tabs.

56560 (INIS-mf—11310, pp 35) Optimization of a breeder-converter system according to a energy demand forecast. Weger, I. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

56561 (INIS-SU—38/A, pp 28-30) Effect of non-uniformity in coolant flow distribution through the volume of heat exchangers on their efficiency. Vladimirova, L.I.; Efanov, A.D.; Yur'ev, Yu.S. 1987. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88780178/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 6.

In Physics and technology of nuclear reactors. Scientific-technical collection.

Thermohydraulic irregularities in the BN-600 facility intermediate heat exchangers induced by lateral feed and removal of intertubular space coolant, heat-transfer tubes annular package peculiarity, tube bundle deformation, existing tolerances for heat-transfer tubes manufacturing, hole centres shifting while drilling of tube boards are considered. It is shown, that with mixed convection effect regard coolants mutual movements essentially affect efficiency, whereupon with heating coolant movement in gravity force direction heat exchanger efficiency increases and with reverse flow - decreases and modes with coolant 'flip-flop' are possible. 9 refs.; 1 fig.

56562 (NIIAR—19(730)) Evaluation of heat fluxes into reaction zone of steam generator during large water leak in sodium. Chernobrovkin, Yu.V. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1987. 24p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704399/JAW.

An experiment on large sodium leakage into water in Czechoslovak PG-1 steam generator of the BOR-60 plant is described. Steam was fed into sodium through 7 mm in-diameter nozzle with 0.2 kg/s mass flowrate for 43 s. Experimental data, characterizing time dependence of temperature variation of the steam generator design blocks due to reaction zone heat influence, are obtained. The method for reconstruction of heat fluxes in metal structures by tem-

perature variation is suggested, and calculated evaluations the fluxes over the module vessel are performed. The maximal calculated heat flux value is 6x10/sup 5/ W/m/sup 2/. Heat and hydrodynamic analysis of processes at large leakage is performed, which allowed to formulate the physical model of thermal effects of the reaction zone on metal structures. 7 refs.; 11 figs.; 2 tabs.

56563 (WHC-SA—0262) Analysis and results of a hydrogen moderated isotope production assembly in the Fast Flux Test Facility. Wootan, D.W.; Rawlins, J.A.; Carter, L.L.; Brager, H.R.; Schenter, R.E. (Westinghouse Hanford Co., Richland, WA (USA)). Jun 1988. Contract AC06-87RL10930. 12p. (CONF-880911—19). NTIS, PC A03/MF A01. Order Number DE89000511/JAW.

From International reactor physics conference; Jackson Hole, WY, USA (18 Sep 1988).

A cobalt test assembly containing yttrium hydride pins for neutron moderation was irradiated in the Fast Flux Test Facility during Cycle 9A for 137.7 equivalent full-power days at a power level of 291 MW. The 36 test pins consisted of a batch of 32 pins containing cobalt metal used to produce ^{60}Co and a set of four pins with europium oxide to produce ^{153}Gd, a radioisotope used in detection of the bone disease osteoporosis. Postirradiation examination of the cobalt pins determined the ^{60}Co was produced with an accuracy of about 5%. The measured ^{60}Co spatially distributed concentrations were within 20% of the calculated concentrations. The assembly average ^{60}Co measured activity was 4% less than the calculated value. The europium oxide pins were gamma scanned for the europium isotopes ^{152}Eu and ^{154}Eu to an absolute accuracy of about 10%. The measured europium radioisotope and ^{153}Gd concentrations were within 20% of calculated values. The hydride assembly performed well and is an excellent vehicle for many Fast Flux Test Facility isotope production applications. The results also demonstrate the accuracy of the calculational methods developed by the Westinghouse Hanford Company for predicting isotope production rates in this type of assembly. 4 refs., 5 figs., 2 tabs.

56564 (WHC-SA—0283) Thermal conductivity of neutron-irradiated $LiAlO_2$ at different densities. Ethridge, J.L.; Miller, A.D. (Westinghouse Hanford Co., Richland, WA (USA)). Apr 1988. Contract AC06-87RL10930. 16p. (CONF-880504—8). NTIS, PC A03/MF A01. Order Number DE89000639/JAW.

From 90. annual meeting of American Ceramic Society; Cincinnati, OH, USA (1 May 1988).

Pellets of phase-pure, sintered gamma-$LiAlO_2$ at various densities were irradiated in the EBR-II fast flux (neutron energy > 0.1 MeV) nuclear reactor. As-fabricated pellet densities ranged from nominal values of 60% to 95% of theoretical density (TD). Samples were irradiated to lithium burnups of 5.5 {times} 10^{20} captures/cm_3 at temperatures of 973–1173 K. Comparisons are made between measured thermal conductivities for irradiated samples and unirradiated archive samples in the temperature range of 373–1173 K to quantify observed changes as a result of neutron irradiation. 6 refs., 7 figs., 1 tab.

56565 Spectral tailoring device. Brager, H.R.; Schenter, R.E.; Carter, L.L.; Karnesky, R.A. US Patent Application 6-081,956. 5 Aug 1987. 21p. Contract AC06-76FF02170. NTIS, PC A03/MF A01.

A spectral tailoring device for altering the neutron energy spectra and flux of neutrons in a fast reactor thereby selectively to enhance or inhibit the transmutation rate of a target metrical to form a product isotope. Neutron moderators, neutron filters, neutron absorbers and neutron reflectors may be used as spectral tailoring devices. Depending on the intended use for the device, a member from each of these four classes of materials could be used singularly, or in combination, to provide a preferred neutron energy spectra and flux of the neutrons in the region of the target material. In one embodiment of the invention, an assembly is provided for enhancing the production of isotopes, such as cobalt 60 and gadolinium 153. In another embodiment of the invention, a spectral tailoring device is disposed adjacent a target material which comprises long lived or volatile fission products and the device is used to shift the neutron energy spectra and flux of neutrons in the region of the fission products to preferentially transmute them to produce a less volatile fission product inventory. 6 figs.

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

56566 (LA-UR—88-3252) System aspects of a Space Nuclear Reactor Power System. Jaffe, L.; Fujita, T.; Beatty, R.; Bhandari, P.; Chow, E.; Deininger, W.; Ewell, R.; Grossman, M.; Kia, T.; Nesmith, B. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 18p. (CONF-880702—24). NTIS, PC A03/MF A01. Order Number DE89000342/JAW.

From 23. intersociety energy conversion engineering conference; Denver, CO, USA (31 Jul 1988).

Selected systems aspects of a 300 kW nuclear reactor power system for spacecraft have been studied. The approach included examination of two candidate missions and their associated spacecraft, and a number of special topics dealing with the power system design and operation. The missions considered were a reusable orbital transfer vehicle and a space-based radar. The special topics included: power system configuration and scaling, launch vehicle integration, operating altitude, orbital storage, start-up, thawing, control, load following, procedures in case of malfunction, restart, thermal and nuclear radiation to other portions of the spacecraft, thermal stresses between subsystems, boom and cable designs, vibration modes, altitude control, reliability, and survivability. Among the findings are that the stowed length of the power system is important to mission design and that orbital storage for months to years may be needed for missions involving orbital assembly. The power system design evolved during the study and has continued to evolve; the current design differs somewhat from that examined in this paper.

56567 (LA-UR—88-3253) Nuclear reactor power as applied to a space-based radar mission. Jaffe, L.; Fujita, T.; Beatty, R.; Bhandari, P.; Chow, E.; Deininger, W.; Ewell, R.; Grossman, M.; Kia, T.; Nesmith, B. (Los Alamos National Lab., NM (USA); National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1988. Contract W-7405-ENG-36. 17p. (CONF-880702—23). NTIS, PC A03/MF A01. Order Number DE89000341/JAW.

From 23. intersociety energy conversion engineering conference; Denver, CO, USA (31 Jul 1988).

The SP-100 Project was established to develop and demonstrate feasibility of a space reactor power system (SRPS) at power levels of 10's of kilowatts to a megawatt. To help determine systems requirements for the SRPS, a mission and spacecraft were examined which utilize this power system for a space-based radar to observe moving objects. Aspects of the mission and spacecraft bearing on the power system were the primary objectives of this study; performance of the radar itself was not within the scope. The study was carried out by the Systems Design Audit Team of the SP-100 Project. (3 refs., 6 figs., 2 tabs.)

56568 Thermionic reactor module with thermal storage reservoir. Kennel, E.B. (to Secretary of the Air Force, Washington, DC). US Patent 4,755,350. 5 Jul 1988. Filed date 11 Mar 1987. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A thermionic energy conversion system assembly is described comprising: (a) a source of heat; (b) a plurality of emitter electrodes thermally coupled to and generally enclosed by the source of heat; (c) a plurality of collector electrodes in a spaced relationship from and generally enclosed by the emitter electrodes; and, (d) a heat sink generally enclosed by the collector electrodes.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 56641, 56642

56569 (INIS-mf—11311, pp 5) **Governmental control of radiation protection in nuclear power plants of the GDR - status and tendencies.** Ackermann, L.; Arndt, E.; Nessau, L. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

56570 **(NUREG—0540-Vol.10-No.6) Title list of documents made publicly available, June 1-30, 1988.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services). Sep 1988. 451p. NTIS, PC A20/MF A01 - GPO. Order Number TI89001014/JAW.

The Title List of Documents Made Publicly Available is a monthly publication. It contains descriptions of the information received and generated by the US Nuclear Regulatory Commission (NRC). This information includes (1) docketed material associated with civilian nuclear power plants and other uses of radioactive materials and (2) nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. As used here, docketed does not refer to Court dockets; it refers to the system by which NRC maintains its regulatory records. This series of documents is indexed by a Personal Author Index, a Corporate Source Index, and a Report Number Index. The docketed information contained in the Title List includes the information formerly issued through the Department of Energy publication Power Reactor Docket Information, last published in January 1979. Microfiche of the docketed information listed in the Title List is available for sale on a subscription basis from the National Technical Information Service (NTIS). See Notes at the end of the Preface for the complete NTIS address. We encourage your comments, criticisms, and suggestions. In particular, if there are title descriptions that are not meaningful, please let us know so that we can correct the data base. In so far as possible, we would like this document to be a valuable part of your reference material.

56571 **(NUREG—0540-Vol.10-No.7) Title list of documents made publicly available, July 1--31, 1988.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Administration and Resources Management). Oct 1988. 397p. NTIS, PC A17/MF A01 - GPO. Order Number TI89001756/JAW.

The Title List of Documents Made Publicly Available is a monthly publication. It contains descriptions of the information received and generated by the US Nuclear Regulatory Commission (NRC). This information includes (1) docketed material associated with civilian nuclear power plants and other uses of radioactive materials and (2) nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. As used here, docketed does not refer to Court dockets; it refers to the system by which NRC maintains its regulatory records. This series of documents is indexed by a Personal Author Index, a Corporate Source Index, and a Report Number Index. The docketed information contained in the Title List includes the information formerly issued through the Department of Energy publication Power Reactor Docket Information, last published in January 1979. Microfiche of the docketed information listed in the Title List is available for sale on a subscription basis from the National Technical Information Service (NTIS). See NOTES at the end of the Preface for the complete NTIS address.

56572 **(NUREG/CR—2000-Vol.7-No.8) Licensee Event Report (LER) compilation: For month of August 1988.** (Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data; Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 147p. (ORNL/NSIC—200-Vol.7-No.8). NTIS, PC A07/MF A01 - GPO. Order Number TI89001687/JAW.

This monthly report contains Licensee Event Report (LER) operational information that was processed into the LER data file of the Nuclear Safety Information Center (NSIC) during the one month period identified on the cover of the document. The LERs, from which this information is derived, are submitted to the Nuclear Regulatory Commission (NRC) by nuclear power licensees in accordance with federal regulations. Procedures for LER reporting for revisions to those events occurring prior to 1984 are described in NRC Regulatory Guide 1.16 and NUREG-1061, Instructions for Preparation of Data Entry Sheets for Licensee Event Reports. For those events occurring on and after January 1, 1984, LERs are being submitted in accordance with the revised rule contained in Title 10 Part 50.73 of the Code of Federal Regulations (10 CFR 50.73---Licensee Event Report System) which was published in the Federal Register (Vol. 48, No. 144) on July 26, 1983. NUREG-1022, Licensee Event Report System---Description of Systems and Guidelines for Reporting, provides supporting guidance and information on the revised LER rule.

2108 Economics

REFER ALSO TO CITATION(S) 56633

56573 **(HSK-AN—2020) Report about the Swiss nuclear facilities in 1987.** (Bundesamt fuer Energiewirtschaft, Wuerenlingen (Switzerland). Abt. fuer die Sicherheit der Kernanlagen). Mar 1988. 66p. (In German). Bundesamt fuer Energiewirtschaft, Bern (CH).

The report concerns safety in Swiss nuclear facilities in 1987 from the perspective of the Department of Safety in Nuclear Facilities (HSK). 3 figs., 15 tabs.

56574 **Financing nuclear power plant decommissioning.** Malko, J.R. (Utah State Univ., Logan (USA)). *Forum for Applied Research and Public Policy (Knoxville,Tennessee);* **2**: No. 4, 5-13(Win 1987).

Much is at stake in developing a financial strategy for decommissioning nuclear power plants. Since decommissioning experience is limited to relatively small reactors, will the costs associated with larger reactors be significantly higher. Certainly the decommissioning issue intersects with other critical issues that will help to determine the future of commercial nuclear power in the US. The author examines briefly the basic concepts and terms related to decommissioning expenses, namely: (1) segregated fund; (2) non-segregated fund; (3) external method; and (4) internal method. He concludes that state regulatory commissions have turned increasingly to the external funding method because of increasing costs and related problems associated with nuclear power, changing conditions and uncertainties concerned with utility restructuring, and recent changes in federal tax laws related to decommissioning. Further, this trend is likely to continue if financial assurance remains a primary concern of regulators to protect this public interest.

56575 **Decommissioning nuclear power plants: a case for external funding.** Hendren, C.B. (Missouri Public Service Commission, Jefferson City (USA)). *Forum for Applied Research and Public Policy (Knoxville,Tennessee);* **2**: No. 4, 14-17(Win 1987).

In deciding how to finance the decommissioning of nuclear power plants, there are five basic criteria for choosing between internal and external funding methods: (1) the desire for financial assurance, (2) the cost of the assurance, (3) the degree of equity in the recovery program, (4) the program's ability to respond to changes, and (5) the program's adaptability to different utilities. To fulfill its obligations to protect long-term public interests, the Missouri Public Service Commission decided it had to assure, to the maximum extent possible, that sufficient decommissioning funds were available when needed. For this reason, it chose the external funding method. In an external fund, the money currently collected from ratepayers to cover decommissioning costs is placed in an independent trust fund comprised of low-risk investments. The funds and the interest they accrue are available to the utility only at the time of decommissioning (and only for that purpose), thus assuring a certain amount of money will be on-hand to cover decommission-

ing costs as they arise. Such a fund may prove critical to the financial well-being of the utility, particularly if one considers that the utility would need additional generating facilities to replace the capacity lost through the retirement of its nuclear plant. 3 references.

56576 **Decommissioning nuclear power plants: a case for internal funding.** Ferguson, J.S. (Deloitte Haskins & Sells, Dallas, TX (USA)). *Forum for Applied Research and Public Policy (Knoxville,Tennessee);* **2**: No. 4, 18-20(Win 1987).

Historically, utilities have exercised sole responsibility for reinvesting capital funds collected from ratepayers. Capital provided by ratepayers, whether for recovery of invested capital or for removal costs, reduces the magnitude of future borrowings - dollar for dollar. If regulatory commissions require utilities to place these collections in separate, inaccessible investment accounts (as in external funding methods), then utilities will be denied the use of these funds. Ratepayers, in turn, will be denied both their usual interest credit and the cost-saving benefits afforded by utilities having readily accessible cash to use instead of having to resort to borrowing. Such benefits can be attained only through internal-funding methods that keep rate payer contributions under unrestricted utility control. While state regulatory commissions currently favor external funding for financial assurance, the author feels the extra cost to ratepayers and the utilities is too high a price to pay.

56577 **Nuclear power plant decommissioning: an unresolved problem.** Pollock, C. (Worldwatch Institute, Washington, DC (USA)). *Forum for Applied Research and Public Policy (Knoxville,Tennessee);* **2**: No. 4, 23-30(Win 1987).

In 1984, the Critical Mass Energy Project asserted that at least 11 US reactors had gone through one-third of their operating lives without collecting any decommissioning funds and that nationwide only $600 million had been collected. This lack of financial planning prompted 10 states to require mandatory periodic deposits into external accounts: California, Colorado, Connecticut, Maine, Massachusetts, Mississippi, New Hampshire, Pennsylvania, Vermont, and Wisconsin. Setting aside decommissioning funds is essential in every country that uses nuclear power. Regardless of a nation's future energy plans, existing plants must eventually be scrapped. Just as today's cities would not be habitable without large fleets of garbage trucks and extensive landfills, the international nuclear industry is not viable without a sound decommissioning strategy. Thirty years after the first nuclear plant started producing electricity, such a strategy has yet to be formulated. More than 500 reactors, including those currently under construction, will have to be decommissioned. Preparing to safely retire these plants requires aggressive, well-funded research and development programs, policy makers willing to tackle unpleasant, long-term problems, and robust retirement accounts funded by today's utility customers.

22 NUCLEAR REACTOR TECHNOLOGY

REFER ALSO TO CITATION(S) 56536

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 56632, 57898, 58311

56578 **(DPST—86-479) Calculated neutron spectrum for HFIR Irradiation of Reactor Materials Program Specimens 1Q, 4M, and 12M.** Parks, P.B. (Savannah River Lab., Aiken, SC (USA)). 5 Jun 1986. Contract AC09-76SR00001. 17p. NTIS, PC A03/MF A01. Order Number DE89000485/JAW.

The contract between the Savannah River Laboratory and the Oak Ridge National Laboratory for the neutron irradiation of stainless steel specimens in the HFIR reactor specifies that The owner [SRL] will provide group fluxes to the contractor [ORNL] one month before dosimetry analysis is commenced. ORNL needs these group fluxes (or neutron spectrum) to analyze the fluence measurements for the 1Q, 4M and 12M needed for the dosimetry performed for the 4C specimen irradiations. 3 refs., 3 tabs., 6 figs.

56579 **(FEI—1837) Technique for calculation of spatial reactor kinetics model for NPP simulator.** Korotin, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1987. 11p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703493/JAW.

Technique for calculation of reactor spatial kinetics model for NPP simulator is suggested. The simulator combines two calculation procedures: procedure for the initial approximation optimizing search (PIAOS) for iterative solution method of operator equation and alternating-triangle method(ATM) with increased dependence. PIAOS is based on the simplest transformation - similarity transformation. It was managed to increase ATM dependence due to direct estimation of energetic equivaleney constants of ATM operator and operator equation. Examples of reactor kinetics model calculation for NPP simulator (840 calculation lattices nodes) are presented. Processor calculation time of one temporal layer for ES-1061 computer is 48 sec. 6 refs.; 2 figs.

56580 **(NEACRP-L—305) Overview of Smorn V-Munich.** Kryter, R.C.; La Wanda, E. Klobe; Hendrix, S.P. (Oak Ridge National Lab., TN (US)). (Nuclear Energy Agency, 75 - Paris (France)). Mar 1988. 37p. (CONF-871013—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755008/JAW.

From 5. SMORN: international conference on reactor noise; Munich, F.R. Germany (12 Oct 1987).

At the recent fifth Symposium on Reactor Noise (SMORN V), over half the participants represented power utilities, and thirteen out of ninety papers covered practical experience of plant monitoring by noise analysis. In 1986 the Nuclear Energy Agency published a State of the Art Report on Reactor Noise Analysis providing an assessment of the applicability of noise techniques to power reactor operations, which was drawn up by a working group of the NEA Committee on Reactor Physics in the aftermath of the 1984 SMORN IV symposium in Dijon. Since that time, the practical applications of noise analysis techniques to plant surveillance have become more widespread, in particular in the areas of loose part detection and vibration monitoring. Theoretical understanding of the methods has continued to improve. These advances were presented at the SMORN V symposium, held in Munich from 12th - 16th October 1987. The meeting also recommended that the 1986 State of the Art report should be updated, and the present overview is intended, like its predecessor, for a wide audience including national safety authorities and managers in the nuclear industry. The full proceedings of the symposium, to be published in 1988 by Pergamon Press, will include all the papers presented at the meeting. This document was assembled and edited at Oak Ridge National Laboratory from the summaries of each session provided by the session chairmen. Topics which were divided into multiple sessions for the purpose of the conference have been regrouped into single chapters. A complete list of the papers presented at the conference is included in the appendix.

56581 **(PSI—3) Analysis of LWHCR-PROTEUS Phase 2 experiments performed using the AARE system with JEF-1 based data libraries, and comparison with other codes.** Pelloni, S.; Stepanek, J. (Paul Scherrer Institut, Labor fuer Reaktorphysik und Systemtechnik, Wuerenlingen (Switzerland)). (Paul Scherrer Inst. (PSI), Wuerenlingen (Switzerland). Lab. fuer Reaktorphysik und Systemtechnik). Apr 1988. 44p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704063/JAW.

In this report the capability of the AARE modular code system and JEF-1 based nuclear data libraries to analyse LWHCR lattices is investigated by calculating the wet and dry cells of the PROTEUS-LWHCR Phase 2 experiment. The results are compared to those obtained using several cell codes, including WIMS-D, BOXER, MICROX-2, KARBUS, GRUCAH, and SPEKTRA. In particular, the main features of AARE, such as the self-shielding of resonance cross sections in the whole energy range of importance for structural materials and actinides (including the low energy resonances of heavy actinides), the shielding of oxygen resonances in the MeV range, the generation of adequate fission source spectra, the accurate calculation of migration areas, and the efficiency of the removal correction are investigated. It is shown

that AARE can predict the k/sub ∞/ void coefficient well with a 1 % deviation from experiment, even if a coarse 70 netron group library is used. KARBUS and the related 69 group KEDAK-4 library give as well a reliable estimate, but lead to less accurate prediction of reaction rates. The other codes give larger deviations. The JEF-1 evaluation for /sup 242/Pu gives systematically about 25 % too high capture rates in the fast energy range (above 1 keV). (author) 39 refs., 24 figs., 13 tabs.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 56580, 56596, 56648, 56650, 56651, 56652, 56654, 56662, 56663, 56672, 57042

56582 (EGG-M—01188) Once through steam generator AFW [auxiliary feedwater] flow distribution and heat transfer. McCreery, G.E.; Larson, T.K.; Condie, K.G. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 14p. (CONF-881160—1). NTIS, PC A03. Order Number DE88015223/JAW.

From Thermal hydraulics of nuclear steam generators/heat exchangers; Chicago, IL, USA (28 Nov 1988).

Experiments have been conducted that model B&W Once Through Steam Generator (OTSG) heat transfer and fluid flow behavior during auxiliary feedwater (AFW) injection. The OTSG is a single-pass counterflow tube-in-shell heat exchanger in which decay heat removal capability is provided by injection of AFW into the steam generator boiler region. The experiments and analysis is described in this paper examine the basic phenomena of AFW radial and axial flow distribution, tube support plate (TSP) flooding, and tube heat transfer. Flow distribution is studied visually and measured in an unheated multitube (625 tubes) full scale 1/8 sector of the OTSG, which includes the top three TSP's. Steam flow is simulated by air flow. Heat transfer is examined in a heated single tube facility with either one or two broached hole support plates and either air or steam upflow. The flow distribution experiments indicate that radial, axial, and azimuthal spreading is a strong function of AFW flow rate and a weaker function of vapor upflow unless the flooding line is approached. A semi-empirical model of AFW penetration without gas flow is presented. The model is extended to include the influence of gas flow by correlation. The heat transfer experiments indicate that heat transfer is highly dependent on AFW injection rate, and in particular on whether or not the water flows down the tubes as a continuous film or breaks into rivulets. A computer model of heat transfer has been developed, and is described. 4 refs., 21 figs.

56583 (INIS-SU—38/A, pp 20-27) Computation of coolant spatial flows in a reactor hydraulic channel. Kumaev, V.Ya.; Leonchuk, M.P.; Shvetsov, Yu.E. 1987. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88780178/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 6.

In Physics and technology of nuclear reactors. Scientific-technical collection.

Field two-dimensional rates reactor discharge header with discharge camera different heights and onlet lattice resistance different values are calculated. The effect of cone displacers on header bottom is analyzed. On the base of numerical solution of two-dimensional equations of motion azimuth irregularity effect on header inlet is studied. Acquisition approach of full equation of coolant three-dimensional flow in fuel element clusters is considered on the base of cell-by-cell approach. The calculation results of three-dimensional flows in fuel element clusters with blocking are presented. 13 refs.; 9 figs.

56584 (INIS-SU—38/A, pp 31-35) Deterioration of thermal and hydraulic indices of a helical-type steam generator as a result of neglecting by physical and design parameter deviations. Lebedev, M.E.; Firsova, Eh.V.; Fokin, B.S. 1987. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88780178/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 6.

In Physics and technology of nuclear reactors. Scientific-technical collection.

It is shown, that spiral vibrations in coolant flow occuring due to unsatisfactory spacing may essentially (up to 45%) increase its hydraulic resistanse. It is also shown, that neglect of coolant distribution irregularity along spiral both sides leads to noticeable error in its heat transfer determination, when it is flowed around by liquid sodium. 3 refs.; 3 figs.

56585 (INIS-SU—38/A, pp 36-39) Effect of parameters of viscous-gravity flow of gaseous coolant on thermohydraulic behaviour of a natural circulating circuit. Luzin, I.P.; Fedorovich, E.D.; Vdovets, V.N. 1987. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88780178/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 6.

In Physics and technology of nuclear reactors. Scientific-technical collection.

The necessity of taking into considiration a natural-circulating circuit of coolant flow viscous-gravity character for thermohydraulic calculation is given. Investigations, made on facilities with gas natural circulation, allowed to estimate dependences describing heat exchange processes intensification and channels hydraulic resistance under viscous-gravity coolant flow conditions in comparison with forced laminar flow conditions. Introduction of correction coefficients determined by these dependences, into thermohydraulic calculation allows to increase calculation accuracy, which is proved by comparison of calculation results with experimental data. 7 refs.; 3 figs.

56586 (INIS-SU—38/A, pp 40-42) Coolant mixing in helical tube bundles in unsteady mode. Bagdonavichyus, A.B. 1987. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88780178/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 6.

In Physics and technology of nuclear reactors. Scientific-technical collection.

The numerical calculation technique of coolant temperature unstable fields in helical tube bundles is developed on the basis of homogenized fluid flow model. Differential equations describing flow include terms with rate components in both axial and radial directions. The technique is based experimentally, comparing experimental distributions by beam radius with temperature fields calculation results with abrupt thermal load decrease for helical tube heat exchanger model. 3 refs.; 1 fig.

56587 (INIS-SU—38/A, pp 48-52) Effect of deviations of rods in radial flow from equilibrium positions on the hydrodynamic excitation of vibrations. Terenik, L.V.; Fedotovskij, V.S.; Sinyavskij, V.F. 1987. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88780178/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 6.

In Physics and technology of nuclear reactors. Scientific-technical collection.

The experimental investigation results of rod element vibrations in liquid cross flow under restricted conditions are presented. Restricted conditions were provided by the stiff cylindrical channel with longitudinal slits for the flow inlet and outlet. Experimental section geometry simulated conditions of liquid cross flow in tubal bundle. It is shown, that vibrations excitation character by liquid flow, rod vibrations amplitude, vibrations hydrodynamic damping depend essentially on rod position in the channel. It is determined, that rod vibrations with inadmissibly large amplitude, restricted by channel sides, may occur witn coolant flow rate which is essentially lower, than values obtained by available calculated relationships. 5 refs.; 6 figs.

56588 (INIS-SU—38/A, pp 72-75) Effect of flow swirling on the two-sided heat transfer in channels. Budov, V.M.; Dmitriev, S.M. 1987. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88780178/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 6.

In Physics and technology of nuclear reactors. Scientific-technical collection.

Coefficients of heat transfer and hydraulic resistance in heat exchangers with an internal spirally swirled tube at two-sided heating in a wide range of geometrical parameters at implied motion of a one-phase coolant are studied experimentally. The experiments were conducted at the following parameters of the investigated

flow; pressure at the outlet to the channel is up to 2 MPa, its temperature is 320-400 K. The range of Reynolds number variation is equal to (2-40)x10/sup 3/. The results of the investigations must be brought to criterial equations. 2 refs.; 2 figs.; 1 tab.

56589 **(NUREG—1222) Piping research program plan.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering). Sep 1988. 61p. NTIS, PC A04/MF A01 - GPO. Order Number TI89000575/JAW.

This document presents the piping research program plan for the Structural and Seismic Engineering Branch and the Materials Engineering Branch of the Division of Engineering, Office of Nuclear Regulatory Research. The plan describes the research to be performed in the areas of piping design criteria, environmentally assisted cracking, pipe fracture, and leak detection and leak rate estimation. The piping research program addresses the regulatory issues regarding piping design and piping integrity facing the NRC today and in the foreseeable future. The plan discusses the regulatory issues and needs for the research, the objectives, key aspects, and schedule for each research project, or group of projects focussing of a specific topic, and, finally, the integration of the research areas into the regulatory process is described. The plan presents a snap-shot of the piping research program as it exists today. However, the program plan will change as the regulatory issues and needs change. Consequently, this document will be revised on a bi-annual basis to reflect the changes in the piping research program. 55 refs.

56590 **(NUREG/CR—4659-Vol.2) Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR): Programmer's guide.** Call, O.J.; Jacobson, J.A. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1988. Contract AC07-76ID01570. 297p. (EGG—2458-Vol.2). NTIS, PC A13/MF A01 - GPO. Order Number TI89001453/JAW.

The Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR) is an automated data base management system for processing and storing human error probability and hardware component failure data. The NUCLARR system software resides on an IBM (or compatible) personal micro-computer and can be used to furnish data inputs for both human and hardware reliability analysis in support of a variety of risk assessment activities. The NUCLARR system is documented in a five-volume series of reports. Volume 2 of this series is the Programmer's Guide for maintaining the NUCLARR system software. This Programmer's Guide provides, for the software engineer, an orientation to the software elements involved, discusses maintenance methods, and presents useful aids and examples. 4 refs., 75 figs., 1 tab.

56591 **(NUREG/CR—4880-Vol.2) Characterization of irradiated current-practice welds and A533 Grade B Class 1 plate for nuclear pressure vessel service: Volume 2.** McGowan, J.J.; Nanstad, R.K.; Thoms, K.R. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Oak Ridge National Lab., TN (USA)). Jul 1988. Contract AC05-84OR21400. 478p. (ORNL—6484/V2). NTIS, PC A21 - GPO. Order Number TI89001398/JAW.

Studies of the effects of neutron irradiation on fracture toughness properties of steels have generally included a minimum number of tests for each material condition. The present study attempts to apply statistical analyses, with multiple testing at selected temperatures, to assess the accuracy and reliability of the results. Fracture toughness test specimens were irradiated in the Bulk Shielding Reactor at Oak Ridge National Laboratory at 288{degree}C to target neutron fluences of 2 {times} 10^{23} neutrons/m^2 (>1 MeV). The materials were ASTM A533 grade B class 1 plate (HSST Plate 02) and four submerged-arc welds representing the current fabrication practice for nuclear pressure vessels. Both unirradiated and irradiated specimens were tested by two separate laboratories, and multiple tests were conducted at selected temperatures. Statistical analyses permitted the determination of material and test variability and an interlaboratory comparison. Behavior in both the transition and ductile-shelf regions was studied. The results demonstrated the relatively low radiation sensitivity of low copper/nickel welds and the qualitative agreement between Charpy impact and fracture toughness observations of toughness degradation.

56592 **(NUREG/CR—4880-Vol.2) Characterization of irradiated current-practice welds and A533 grade B class 1 plate for nuclear pressure vessel service.** McGowan, J.J.; Nanstad, R.K.; Thoms, K.R. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Oak Ridge National Lab., TN (USA)). Jul 1988. Contract AC05-84OR21400. 478p. (ORNL—6484/V2). NTIS, PC A21 - GPO. Order Number TI89001390/JAW.

Studies of the effects of neutron irradiation on fracture toughness properties of steels have generally included a minimum number of tests for each material condition. The present study attempts to apply statistical analyses, with multiple testing at selected temperatures, to assess the accuracy and reliability of the results. Fracture toughness test specimens were irradiated in the Bulk Shielding Reactor at Oak Ridge National Laboratory at 288{degree}C to target neutron fluences of 2 {times} 10^{23} neutrons/m^2 (>1 MeV). The materials were ASTM A533 grade B class 1 plate (HSST Plate 02) and four submerged-arc welds representing the current fabrication practice for nuclear pressure vessels. Both unirradiated and irradiated specimens were tested by two separate laboratories, and multiple tests were conducted at selected temperatures. Statistical analyses permitted the determination of material and test variability and an interlaboratory comparison. Behavior in both the transition and ductile-shelf regions was studied. The results demonstrated the relatively low radiation sensitivity of low copper/nickel welds and the qualitative agreement between Charpy impact and fracture toughness observations of toughness degradation.

56593 **(NUREG/CR—5207) Fracture evaluation of surface cracks embedded in reactor vessel cladding: Material property evaluations.** McCabe, D.E. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Materials Engineering Associates, Inc., Lanham, MD (USA)). Sep 1988. 23p. (MEA—2285). NTIS, PC A03/MF A01 - GPO. Order Number TI89000491/JAW.

The materials that are present in the local region of the clad layer of RPV steel were evaluated for tensile properties and fracture toughness before and after irradiation damage. Residual stresses in the clad region were determined. The information described herein was used to understand the behavior of surface cracks embedded in the clad layer in beam tests conducted in another phase of this investigation. 7 refs.; 12 figs., 4 tabs.

56594 **(SAND—88-0754) Time-temperature-dose rate superposition: A methodology for predicting cable degradation under ambient nuclear power plant aging conditions.** Gillen, K.T.; Clough, R.L. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1988. Contract AC04-76DP00789. 64p. NTIS, PC A04/MF A01. Order Number DE89001582/JAW.

Time-temperature superposition is an empirical approach that has been used in polymers for more than 30 years to make thermal aging predictions at experimentally inaccessible times. Given the historical success of time-temperature superposition, we have expanded this approach for combined radiation-thermal environments, yielding an empirical time-temperature-dose rate shifting procedure. The procedure derives an isothermal curve for a given amount of material damage versus dose rate at a selected reference temperature by finding the Arrhenius activation energy that causes higher-temperature dose-rate data to superpose when shifted to the reference temperature. The resulting superposed curve at the reference temperature expends to much lower dose rates that, in effect, are experimentally inaccessible due to the long time periods which would be required. This procedure therefore allows meaningful predictions to be made under long-term, low-dose rate, radiation aging conditions. Using historical data from our radiation-aging program on nuclear power plant cable materials, we have successfully applied the time-temperature-dose rate superposition approach to four different materials. For two of these materials, extrapolated predictions based on the superposed data were found to be in excel-

lent agreement with 12-year, low-dose rate nuclear power plant results.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 56682, 56687

56595 (INIS-SU—38/A, pp 9-12) **Technique to estimate effect of initial data inaccuracyies on the results of fuel element inherent temperature calculation.** Gulevich, A.V.; Zrodnikov, A.V.; Tsupko, V.Ya. 1987. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88780178/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 6.

In Physics and technology of nuclear reactors. Scientific-technical collection.

Application of thermal conductivity conjugate equations in the task about initial data indetermination effect on calculated temperature values in fuel element is considered. Application of conjugate equation allows to develop perturbation theory and to obtain equations suited for engineering estimations of negligible effect of thermophysical and geometrical parameters deviations from nominal ones on characteristic temperature in cylindrical fuel element meat (maximal temperature in 'critical' cross-section, surface temperature etc). 5 refs.; 1 tab.

56596 (INIS-SU—38/A, pp 43-47) **Effect of artificial roughness and helical wrapping at elastic rods on their vibration performance in longitudinal fluid flow.** Fedotovskij, V.S.; Spirov, V.S. 1987. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88780178/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 6.

In Physics and technology of nuclear reactors. Scientific-technical collection.

Experimental investigation results of exciting forces and vibration characteristics of single smooth rods with artificial roughness in axial water flow are presented. Experimental dependences of exciting forces affecting single rod, pressure pulsations in turbulent flow, vibration frequency and 0-20 flow rate range are given. It is shown, that for rods with artificial roughness vibration is approximately one order higher, than smooth rods vibration amplitude. At the same time, for rough rods investigated variants with 5-10 m/s occurs dynamic instability of flutter type. 5 refs.; 7 figs.

2204 Control Systems

REFER ALSO TO CITATION(S) 56644

56597 (EPRI-NP—5719-Vol.1) **Reactor emergency action level monitor: Volume 1, REALM technical report: Final report.** Touchton, R.A. (Electric Power Research Inst., Palo Alto, CA (USA); Technology Applications, Inc., Jacksonville, FL (USA)). Sep 1988. 320p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89000574/JAW.

The technical background, development methodology, and functional description of the Reactor Emergency Action Level Monitor (REALM) expert system prototype are provided in this volume. REALM has been designed to provide expert assistance in the identification of a nuclear power plant emergency situation and the determination of its severity. REALM has been developed as an expert system which can provide sensor interpretation and situation assessment in a real-time processing environment. In its state of development at project completion, these capabilities are used in an off-line (i.e., stand-alone, desktop) fashion to provide emergency preparedness assistance in the areas of emergency classification training and emergency exercise scenario generation. REALM also serves as a prototype and stepping-stone for the possible connection to the plant for on-line use. In order to distinguish the off-line system (now complete) from the on-line system (now moving from a research prototype to an installed system), the term "REALM" is used to indicate the on-line version, with users in the control room, technical support center, and the emergency operations facility. The off-line version is referred to as "uREALM."

56598 (IAE—4449/4) **Processing the readings of in-pile heat release detectors.** Grachev, E.V.; Shevelev, Ya.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1987. 33p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703503/JAW.

Derivation of general mathematical relations that may be used in solving the problem of energy release field reconstruction in reactor cores (calculation of energy release detailed distribution for the reactor state at certain readings of in-pile heat release detectors) is presented. Formulae suitable for practical algorithm computer presentation are obtained. During the field reconstruction physical calculation program parameters are corrected, their error and the reconstructed field error are calculated. Algorithm possibilities as applied to the RBMK reactor are manifested. It is concluded that the use of complete volume of apior information provides maximal accuracy of heat release field determination. Therewith even at such discreteness as in RBMK (one detector for 14 channels) the field reconstruction error for all channels will not exceed the measurement error. Any representation roughening of calculation-experimental divergence covariant matrix results in increase of the error. 36 refs.; 4 figs.

56599 (KWU-R—914/82/020) **Reactor core protection system using a 4-channel microcomputer. Final report.** Mertens, U. (Kraftwerk Union A.G., Erlangen (Germany, F.R.). Abt. Entwicklung Reaktor-Leittechnik). (Kraftwerk Union A.G., Erlangen (Germany, F.R.). Reaktorentwicklung). Dec 1982. 122p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755188/JAW.

A four channel microcomputer system was fitted in Grafenrheinfeld NPP for local core protection. This system performs continuous on-line monitoring of peak power density, departure from nucleate boiling ratio and fuel duty. The system implements limitation functions with more sophisticated criteria and improved accuracy. The Grafenrheinfeld system points the way to the employment of computer based limitation system, particularly in the field of programming language, demarkation of tasks, commissioning and documentation aids, streamlining of qualification and structuring of the system.

56600 (NUREG/CP—0086-Vol.2, pp 1139-1147) **Control room temperature survey at a pressurized water reactor nuclear power station.** Olson, P.E. (Flakt, Inc., Winston-Salem, NC (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

During preoperational testing at a near term operating license (NTOL) pressurized water reactor power facility, numerous printed circuit board failure and out of calibration instrument loops have been encountered. This, coupled with licensee event reports filed by other operating stations, I. & E. notices, etc., prompted the utility to conduct a survey of various control panels and logic racks in the control room to determine operating temperatures. The completion of all activities associated with this survey are expected to result in longer qualified life for components, less time expended on calibration activities, and more reliable instrument loop indication and operation. This paper discusses the testing methodology and preliminary work performed to give the best possible results.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 56271, 56624, 56634, 56679, 56689, 57477, 57478, 57503

56601 (BNL-NUREG—41553) **Analysis of fission product revaporization in a BWR reactor cooling system during a station blackout accident.** Yang, J.W.; Schmidt, E.; Cazzoli, E.; Khatib-Rahbar, M. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 28p. (CONF-881011—19). NTIS, PC A03/MF A01. Order Number DE88015860/JAW.

From Joint meeting of the European Nuclear Society and the American Nuclear Society; Washington, DC, USA (30 Oct 1988).

This report presents a preliminary analysis of fission product revaporization in the Reactor Cooling System (RCS) after the vessel failure. The station blackout transient for BWR Mark I Power Plant is considered. The TRAPMELT3 models of evaporization, chemisorption, and the decay heating of RCS structures and gases are adopted in the analysis. The RCS flow models based on the density-difference between the RCS and containment pedestal region are developed to estimate the RCS outflow which carries the revaporized fission product to the containment. A computer code called REVAP is developed for the analysis. The REVAP is incorporated with the MARCH, TRAPMELT3 and NAUA codes of the Source Term Code Pack Package (STCP). The NAUA code is used to estimate the impact of revaporization on environmental release. The results show that the thermal-hydraulic conditions between the RCS and the pedestal region are important factors determining the magnitude of revaporization and subsequent release of the volatile fission product. 8 figs., 1 tab.

56602 **(BNL-NUREG—41635) ALARA: Progress and prospects.** Khan, T.A.; Baum, J.W. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 14p. (CONF-8809138—1). NTIS, PC A03/MF A01. Order Number DE88016727/JAW.

From 10. anniversary of the Westinghouse REM seminar; Pittsburgh, PA, USA (12 Sep 1988).

This paper has two main topics. The first part describes the establishment and work of the ALARA Center; the second part presents some results of studies at the Center with international data on doses at PWR plants. This data then is used to reach a preliminary understanding of some of the factors that are causing high doses at PWRs. This approach should help in reducing occupational exposures in a more effective manner.

56603 (EPRI-CS/EA/AP—5663-SR, pp 4.13-4.25) **Field testing of behavioral barriers for cooling water intake structures -test site 1 - Pickering Nuclear Generating Station.** Patrick, P.H.; McKinley, R.S.; Micheletti, W.C. (Ontario Hydro, Toronto (Canada)). Mar 1988. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88920262/JAW. (CONF-8710303—).

From Fish protection at steam and hydroelectric power plants; San Francisco, CA, USA (28 Oct 1987).

A multi-year research program was developed by the Electric Power Research Institute to evaluate the effectiveness of selected behavioral systems for fish exclusion at sites representative of different aquatic environments. The first test site was the Pickering Nuclear Generating Station (NGS) located on Lake Ontario which represented the Great Lakes environment. A single pneumatic popper, a low frequency, high amplitude sound deterrent, was found to effectively exclude adult alewife, the principal species impinged at Pickering NGS. An air bubble curtain, used either alone or combined with strobe lights, was not a consistent deterrent. Effectiveness of air bubbles was only enhanced when used in association with a popper. Strobe lights were the least effective of the three devices tested. Operation of all three devices together did not surpass the effectiveness of the popper when used alone. Sound deterrents show promise for fish exclusion at generating stations located on the Great Lakes.

56604 **(EPRI-NP—5991) Improved PWR waste liquid processing using zeolite and organic ion-exchange materials: Final report.** Jacob, N.P. (Electric Power Research Inst., Palo Alto, CA (USA); Babcock and Wilcox Co., Lynchburg, VA (USA). Lynchburg Research Center). Sep 1988. 66p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89000248/JAW.

This report presents the results of the logical culmination of the test program, a full-scale demonstration of the improved ion-exchange process for selective radionuclide removal. This report is entitled "Improved PWR Waste Liquid Processing Using Zeolite and Organic Ion-Exchange Materials". The objective of the full-scale test was to verify the technical approach and process economics developed using comparative column test data. In addition, this demonstration would provide credibility for the improved process in the nuclear power industry. 9 refs., 24 figs., 14 tabs.

56605 **(GA-A—19439) Environmental aspects of MHTGR [Modular High-Temperature Gas-Cooled Reactor] operation.** Neylan, A.J.; Dilling, D.A.; Cardito, J.M. (General Atomics Co., San Diego, CA (USA); Bechtel National, Inc., San Francisco, CA (USA); Stone and Webster Engineering Corp., Boston, MA (USA)). Sep 1988. Contract AC03-88SF17367. 15p. (CONF-8809150—1). NTIS, PC A03/MF A01. Order Number DE88017340/JAW.

From IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors; San Diego, CA, USA (21 Sep 1988).

The Modular High-Temperature Gas-Cooled Reactor (MHTGR) is an advanced reactor concept being developed under a cooperative program involving the US Government, the utilities and the nuclear industry. This plant design utilizes basic High Temperature Gas-Cooled Reactor (HTGR) features of ceramic fuel, helium coolant, and a graphite moderator. The MHTGR design approach leading to exceptional safety performance also leads to plant operation which is characterized by extremely low radiological emissions even for very low probability accidents. Coated fuel particles retain radionuclides within the fuel, thus minimizing material contamination and personnel exposure. The objective of this paper is to characterize radioactive effluents expected from the normal operation of an MHTGR. In addition, other nonradioactive effluents associated with a power generating facility are discussed. Nuclear power plants produce radioactive effluents during normal operation in gaseous, liquid and solid forms. Principal sources of radioactive waste within the MHTGR are identified. The manner in which it is planned to treat these wastes is described. Like other reactors, the MHTGR produces nonradioactive effluents associated with heat generation and chemical usage. However, due to the MHTGR's higher efficiency, water usage requirements and chemical discharges for the MHTGR are minimized relative to other types of nuclear power plants. Based upon prior operating HTGR experience and analysis, effluents are quantified in terms of radioactivity levels and/or emission volume. Results, quantified within the paper, demonstrate that effluents from the MHTGR are well below regulatory limits and that the MHTGR has a minimal impact upon the public and the environment. 14 refs., 2 figs., 4 tabs.

56606 **(INIS-BR—1152) Nuclear energy and environment.** Alves, R.N. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro). 1987. 146p. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88703555/JAW.

A general view about the use of energy for brazilian development is presented. The international situation of the nuclear field and the pacific utilization of nuclear energy in Brazil are commented. The safety concepts used for reactor and nuclear facilities licensing, the environmental monitoring program and radiation protection program used in Brazil are described. (E.G.).

56607 **(NUREG—0837-Vol.8-No.2) NRC TLD direct radiation monitoring network: Progress report, April--June 1988.** Struckmeyer, R.; McNamara, N. (Nuclear Regulatory Commission, King of Prussia, PA (USA). Region I). Sep 1988. 232p. NTIS, PC A11/MF A01 - GPO. Order Number TI89001017/JAW.

This report provides the status and results of the NRC Thermoluminescent Dosimeter (TLD) Direct Radiation Monitoring Network. It presents the radiation levels measured in the vicinity of NRC licensed facility sites throughout the country for the second quarter of 1988.

56608 (NUREG/CP—0086-Vol.2, pp 1116-1128) **Design and testing of a sampling line at the stack of a nuclear power plant.** (N.V. tot Keuring van Elektrotechnische Materialen, Arnhem (Netherlands)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

The effluent through the stack of a nuclear power plant must be measured continuously for its content of radioactive matter. The radioactive species to be monitored are noble gases, aerosols, iodines and tritium. Samples taken from the effluent are in general transported from the sampling point to the measuring station. To guarantee a representative monitoring the losses during the transport through the sampling line must be kept low. For the actual situation at Dodewaard nuclear power plant, a long sampling line (50 m) was unavoidable, and for the greater part this line had to be outdoors. A new sampling line was projected and designed in accordance with international standard ISO 2889-1975. The plate-out of aerosols and iodine is dependent on the material of the line. An investigation was carried out on various materials. A stainless steel braided teflon hose proved to be the best. The hose is provided with insulation and a heating coil to prevent condensation and freezing in winter time. The losses in the new line are low or acceptable, so that the radioactive emissions of the plant can be measured with a high degree of reliability.

56609 **Spatial data requirements for emergency response.** Walker, H. (Lawrence Livermore National Lab., Univ. of California, P.O. Box 808, L-262, Livermore, CA (US)). pp 82-86 of Emergency planning. Carroll, J.M. San Diego, CA; Society for Computer Simulation (1985). (CONF-850108—).

From SCS multiconference on modeling and simulation; San Diego, CA, USA (24 Jan 1985).

The Atmospheric Release Advisory Capability (ARAC) provides real-time assessments of the consequences resulting from an atmospheric radioactive material. In support of this operation, a system has been created which integrates numerical models, data acquisition systems, data analysis techniques, and professional staff. Components of this system rely to large degree on spatial data of various kinds. Of particular importance is the rapid generation of digital terrain models for any area in the continental U.S. The digital terrain models are used as input to atmospheric models and serve to familiarize assessors to new areas by presenting the terrain surface as a graphical image. In addition, base map data (roads, rivers, political boundaries) must also be supplied as an overlay to ARAC graphical products. A terrain data base and an associated acquisition system have been developed that provide the required terrain data within ten minutes. This terrain data base was derived from the Defense Mapping Ageny's planar data. A digital base map data base is currently being developed from the U.S. Geographical Survey's 1:2,000,000 Digital Line Graph data as well as their Geographic Names Information System. This base map data base improves ARAC's response to its mapping needs anywhere in the continental U.S.

56610 **Graphics metafile interface to ARAC emergency response models for remote workstation study.** Lawver, B.S. (Lawrence Livermore National Lab., Univ. of California, P.O. Box 808, L-262, Livermore, CA (US)). pp 87-92 of Emergency planning. Carroll, J.M. San Diego, CA; Society for Computer Simulation (1985). (CONF-850108—).

From SCS multiconference on modeling and simulation; San Diego, CA, USA (24 Jan 1985).

The Department of Energy's Atmospheric Response Advisory Capability models are executed on computers at a central computer center with the output distributed to accident advisors in the field. The output of these atmospheric diffusion models are generated as contoured isopleths of concentrations. When these isopleths are overlayed with local geography, they become a useful tool to the accident site advisor. ARAC has developed a workstation that is located at potential accident sites. The workstation allows the accident advisor to view color plots of the model results, scale those plots and print black and white hardcopy of the model results. The graphics metafile, also known as Virtual Device Metafile (VDM) allows the models to generate a single device independent output file that is partitioned into geography, isoopleths and labeling information. The metafile is a very compact data storage technique that is output device independent. The metafile frees the model from either generating output for all known graphic devices or requiring the model to be rerun for additional graphic devices. With the partitioned metafile ARAC can transmit to the remote workstation the isopleths and labeling for each model. The geography database may not change and can be transmitted only when needed. This paper describes the important features of the remote workstation and how these features are supported by the device independent graphics metafile.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 56578, 56646, 56686, 56691, 56692, 57367

56611 **(CAPE—3015) The LTNIF [Low-Temperature Neutron Irradiation Facility] irradiation cryostat.** Coltman, R.R. Jr.; Kerchner, H.R.; Klabunde, C.E. (Oak Ridge National Lab., TN (USA)). [1984]. Contract AC05-84OR21400. 17 H. Order Number TI89001944/JAW.

The Low-Temperature Neutron Irradiation Facility (LTNIF) has been constructed at the Bulk Shielding Reactor (BSR) in the Oak Ridge National Laboratory. The LTNIF provides high radiation intensities and special environmental and testing conditions for qualified experiments. The cryostat assembly diagram is attached.

56612 **(ORNL/TM—10790) Bulk Shielding Facility: Quarterly report, January, February, and March 1988.** Duggins, W.A.; Muggridge, F.E. (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 18p. NTIS, PC A03/MF A01. Order Number DE89001336/JAW.

The Bulk Shielding Reactor (BSR) remained shut down during January, February, and March. Water-quality control in both the reactor primary and secondary cooling systems was satisfactory. The Pool Critical Assembly (PCA) is shut down for shim-safety rod magnets and associated electronic components upgrading. 1 fig., 12 tabs.

56613 **(ORNL/TM—10797) Oak Ridge Research Reactor shutdown maintenance and surveillance: Quarterly report, January, February, and March 1988.** Coleman, G.H.; Laughlin, D.L. (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 18p. NTIS, PC A03/MF A01. Order Number DE89001337/JAW.

The ORR was not operated during January, February, and March of 1988. Maintenance activities, both mechanical and instrument, were essentially routine in nature. This paper covers: shutdowns; instrumentation and reactor controls; process system; and experiment facilities, and gaseous-waste filters. 9 tabs.

56614 **(ORNL/TM—10888) Oak Ridge Research Reactor shutdown maintenance and surveillance: Quarterly report, April, May, and June 1988.** Coleman, G.H.; Laughlin, D.L. (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 20p. NTIS, PC A03/MF A01. Order Number DE89001342/JAW.

The ORR was not operated during April, May, and June of 1988. Maintenance activities, both mechanical and instrument, were essentially routine in nature. This report covers: shutdowns; instrumentation and reactor controls; process system; and experiment facilities, and gaseous-waste filters. 9 tabs.

56615 **(WHC-SA—0292) FFTF [Fast Flux Test Facility] cobalt test assembly results.** Rawlins, J.A.; Wootan, D.W.; Carter, L.L.; Brager, H.R.; Schenter, R.E. (Westinghouse Hanford Co., Richland, WA (USA)). Oct 1987. Contract AC06-87RL10930. 9p. (CONF-880546—36). NTIS, PC A02/MF A01. Order Number DE89001113/JAW.

From International conference on nuclear data for science and technology; Mito, Japan (30 May 1988).

A cobalt test assembly containing yttrium hydride pins for neutron moderation was irradiated in the Fast Flux Test Facility during Cycle 9A for 137.7 equivalent full power days at a power level of 291 MW. The 36 test pins consisted of a batch of 32 pins containing cobalt metal to produce Co-60, and a set of 4 pins with europium oxide to produce Gd-153, a radioisotope used in detection of the bone disease Osteoporosis. Post-irradiation examination of the cobalt pins determined the Co-60 produced with an accuracy of about 5%. The measured Co-60 spatially distributed concentrations were within 20% of the calculated concentrations. The assembly average Co-60 measured activity was 4% less than the calculated

value. The europium oxide pins were gamma scanned for the europium isotopes Eu-152 and Eu-154 to an absolute accuracy of about 10%. The measured europium radioisotope and Gd-153 concentrations were within 20% of calculated values. In conclusion, the hydride assembly performed well and is an excellent vehicle for many Fast Flux Test Facility isotope production applications. The results also demonstrate that the calculational methods developed by the Westinghouse Hanford Company are very accurate. 4 refs., 3 figs., 1 tab.

2207 Plutonium And Isotope Production Reactors

REFER ALSO TO CITATION(S) 56563, 56626, 56646

56616 (DP—1760) Welding process for the 1986 patch repair of the Savannah River C-Reactor. Kanne, W.R. Jr. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Jun 1988. Contract AC09-76SR00001. 71p. NTIS, PC A04/MF A01. Order Number DE89000634/JAW.

A nuclear production reactor cooled and moderated by heavy water at the Savannah River Plant was shut down in 1985 for repair of leaks attributed to stress corrosion cracking of the reactor tank wall. Remove welding of a patch on the tank wall was achieved, but new cracks occurred on the tank wall in the heat-affected zone of the patch weld. The new cracks were due to helium from neutron irradiation of the tank well. The patch was remotely welded to the reactor tank wall by use of Gas Tungsten Arc weld heads controlled by thirty-foot robot arms. The patch consisted of seven segments that covered stress corrosion cracks in the lower circumference of the tank. Development of the welding process, design of the welding equipment, and installation of the patch are documented in this report. Patch segments were individually fitted to the complex tank wall configuration. Segments were only 0.070 inch thick in the center to accommodate thermal stresses. Autogenous welding was used to join the patch segments to the wall and to each other, except where wire feed was required to close a gap between a patch segment and the tank wall. 2 refs., 46 figs., 5 tabs.

56617 (IAE—4314/3) Thermal characteristics of closed thermosyphon with a liquid metal coolant. Ignat'ev, V.I.; Surenkov, A.I.; Fedulov, V.I.; Cherednikov, V.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1986. 12p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703499/JAW.

Study of thermal characteristics of closed thermosyphons with a natural circulation of molten salt coolant is necessary for confirmation of a series of layouts of high-temperature molten salt reactors (MSR) with such heat exchangers. The designed installation is used to study integral thermal responses of vertical closed thermosyphon with coaxial tubular insert. The main characteristics of the experiments: LIF-BeF/sub 2/-UF/sub 4/ coolant (the melting point is 458 deg C); Pr=12-32; working temperature of the coolant is 500-750 deg C; closed thermosyphon structural material is Cr18N10Ti; the wall heat flux in the heating region - 3x10/sup 3/-7x10/sup 3/ W/m/sup 2/; experiment time - 200 hours. Experimental data on the efficiency of heat transfer in the vertical closed thermosyphon with a molten salt coolant at parameters special of the designs of MSR heat exchangers are obtained. These data well agree with the empirical dependence obtained earlier in experiments with a model liquid. No factors influencing the heat transfer efficiency change in closed thermosyphon made of Cr18N10Ti steel with LiF-BeF/sub 2/-UF/sub 4/ melt are detected. 5 refs.; 4 figs.; 4 tabs.

56618 (WHC-SA—0251) Corrosion and hydriding of N Reactor pressure tubes. Lanning, D.D.; Johnson, A.B. Jr.; Trimble, D.J.; Boyd, S.M. (Westinghouse Hanford Co., Richland, WA (USA)). Jun 1988. Contract AC06-87RL10930. 32p. (CONF-880696—1). NTIS, PC A03/MF A01. Order Number DE89000508/JAW.

From 8. international conference on zirconium in the nuclear industry; San Diego, CA, USA (18 Jun 1988).

Along the fueled length of recently examined tubes, the waterside oxide layer thickness increases uniformly from {approximately}3 μm (the pre-installation value) at the inlet end to a maximum of over 50 μm near the peak neutron flux location. The outer surface oxidation levels are about an order of magnitude less. The oxide thicknesses have steadily increased with operating time, which was verified by a tube removal and examination program that spanned the 25-yr reactor lifetime. Oxidation rates were calculated from the waterside oxide layer thickness data. The in-flux oxidation rates are clearly enhanced (at a given temperature) relative to ex-reactor Zircaloy oxidation rates and to out-of-flux rates on actual pressure tubes. The in-flux oxidation rate varies exponentially with absolute temperature, similar to ex-reactor rates. In addition, the in-flux oxidation rate at a given temperature increases significantly as the oxide layer thickness passes from <15 μm to >20 μm. This last trend is in qualitative agreement with recent observations from high-burnup light water reactor (LWR) fuel rods, and with a "Thick-Film Hypothesis" derived from test reactor data on N Reactor tube materials in low- and high-oxygenated coolants. 11 refs., 11 figs., 3 tabs.

56619 (WHC-SA—0317) Braze alloy development for zircaloy. Donovan, A.H. (Westinghouse Hanford Co., Richland, WA (USA)). May 1988. Contract AC06-87RL10930. 16p. NTIS, PC A03/MF A01. Order Number DE89001082/JAW.

The purpose of this study was to find a suitable braze alloy to close the ends of a new fuel design for N Reactor, the defense reactor at the Hanford site, Washington. An alloy composed of Zircaloy-2 + 8 wt % chromium + 8 wt % nickel (Zr2-8Cr-8Ni) was successfully used to obtain an acceptable joint with no voids. Suggestions for future work on end closure development for the new fuel are outlined. This alloy has potential use in any Zircaloy joining applications. 3 refs., 9 figs., 3 tabs.

2209 Reactor Safety

REFER ALSO TO CITATION(S) 56368, 56544, 56546, 56556, 56569, 56589, 56597, 56601, 56608, 57359, 57480, 57481, 57483, 57552, 57974, 57979, 58310

56620 (BNL-NUREG—41417) Reactivity transients during a blowdown in a MSIV [Main Steam Isolation Valves] closure ATWS [Anticipated Transients Without Scram]. Cheng, H.S.; Diamond, D.J. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 8p. (CONF-881011—11). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number TI88012892/JAW.

From Joint meeting of the European Nuclear Society and the American Nuclear Society; Washington, DC, USA (30 Oct 1988).

The objectives of this work are to study the consequences of the reactivity transients during a blowdown in an ATWS event with closure of the Main Steam Isolation Valves (MSIV), and to evaluate the effect of the LPCI (Low Pressure Coolant Injection) system and the sensitivity of plant response to the feedback coefficients. The present work was performed with the BNL Plant Analyzer (BPA). The BPA is a on-line, interactive BWR system code which models the non-homogeneous, non-equilibrium two-phase flow with a drift flux mixture model, the reactor kinetics with a point kinetic model, the thermal conduction with an integral method, and the control and plant protection systems with modern control theory. It also models the balance of plant (BOP) as well as the Mark I containment of a BWR/4. Thus, the BPA is a comprehensive engineering plant analyzer transients as well as accidents (e.g., ATWS and Small Break Loss of Coolant Accidents).

56621 (CEA-CONF—9449) Thermocouples for conditions of aggressive environments. Blanc, J.Y. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie). 1988. 12p. (CONF-8805205—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754992/JAW.

From Sensor '88; Nuremberg, F.R. Germany (3 May 1988).

Two new kinds of thermocouples have been chosen for temperature measurements in the in-pile safety program for light water

reactors performed in France. They must give fuel centerline or roc cladding temperatures and withstand steam oxidation between 1000/sup 0/C and 1800/sup 0/C or higher, under severe fuel damage conditions. We describe briefly both types, then we emphasize on improvements under way concerning the tungsten-rhenium legs, the hafnia insulation and the sheaths materials. Oxidation resistance is achieved mainly by silicides layers, but other possibilities are considered, such as iridium coatings. Some details of insulators manufacturing or sensor assembly are given, as well as other high temperature applications for these thermocouples.

56622 **(CEA-DAS—496) Integration of PWR accidental operation in safety demonstration.** Cornille, Y. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete). Jul 1988. 21p. (In French). (CONF-8805207—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754995/JAW.

From SFEN day on nuclear installation operation in accidental situation; Paris, France (25 May 1988).

In case of accident on a PWR, the limitation of consequencies is made, in a first time, by automatic action of the protection and safeguard systems and then, in a second step, by operators intervention which reset the reactor in a safety state. This operation activity constitutes an essential constituent in the reactor safety and should integrated in the safety demonstration according to rules which explain his importance. After an historical recall of the evolution of the operator intervention in the safety demonstration the author presents the actual application field of the operation procedures and the aims which are assigned at the different families of procedures. Then the author examines for each of these different families the rules according to the safety analysis and the requirements for reactor equipments.

56623 **(CNEA—484) ARGOS PHWR 380. Argentine offer of a safer pressurized heavy-water reactor of 380 MW.** Gonzalez, A.J.; Frischengruber, Kurt; Recalde, J.A.; Solanilla, R.B.A.; Vanzulli, R.C. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Direccion de Planificacion, Coordinacion y Control; Empresa Nuclear Argentina de Centrales Electricas (ENACE), Buenos Aires (Argentina)). (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). 1987. 93p. (In English, Spanish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88703484/JAW.

Informe.

This paper introduces the design of a nuclear power plant of 380 MWe, equipped with a preassure-vessel heavy-water reactor. An explanation is given of the technical, economical and financial factors that led to the design of this medium sized nuclear power plant, which is compatible with the latest advances in the field of nuclear safety.

56624 **(CONF-881014—11) Results of fission product release from intermediate-scale MCCI [molten core-concrete interaction] tests.** Spencer, B.W.; Thompson, D.H.; Fink, J.K.; Gunther, W.H.; Sehgal, B.R. (Argonne National Lab., IL (USA); Electric Power Research Inst., Palo Alto, CA (USA)). 1988. Contract W-31109-ENG-38. 14p. NTIS, PC A03/MF A01. Order Number DE89000596/JAW.

From International European Nuclear Society/American Nuclear Society meeting on thermal reactor safety; Avignon, France (2 Oct 1988).

A program of reactor-material molten core-concrete interaction (MCCI) tests and related analyses are under way at Argonne National Laboratory under sponsorship of the Electric Power Research Institute (EPRI). The particular objective of these tests is to provide data pertaining to the release of nonvolatile fission products such as La, Ba, and Sr, plus other aerosol materials, from the coupled thermal-hydraulic and chemical processes of the MCCI. The first stages of the program involving small and intermediate-scale tests have been completed. Three small-scale tests ({approximately}5 kg corium) and nine intermediate-scale tests ({approximately}30 kg corium) were performed between September 1985 and September 1987. Real reactor materials were used in these tests. Sustained internal heat generation at nominally 1 kW per kg of melt was provided by direct electrical heating of the corium mixture. MCCI tests were performed with both fully and partially oxidized corium mixtures that contained a variety of nonradioactive materials such as La_2O_3, BaO, and SrO to represent fission products. Both limestone/common sand and basaltic concrete basemats were used. The system was instrumented for characterization of the thermal hydraulic, chemical, gas release, and aerosol release processes.

56625 **(CONF-881014—12) Chemical factors affecting fission product release and transport.** Malinauskas, A.P. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01. Order Number DE89000651/JAW.

From International European Nuclear Society/American Nuclear Society meeting on thermal reactor safety; Avignon, France (2 Oct 1988).

The Three Mile Island reactor accident convincingly demonstrated the significance of chemical effects in determining the radiological consequences of severe core damage accidents. Since the time of the accident, considerable research has been conducted to identify those chemical phenomena that can occur in such accidents, and to elucidate the mechanisms which underlie these phenomena. In this report the state of the technology is briefly reviewed and a number of issues still to be resolved are presented. 30 refs.

56626 **(DPST—86-519) "Inherent safety" as applied to new production reactors.** Graves, W.E. (Savannah River Lab., Aiken, SC (USA)). 23 Jun 1986. Contract AC09-76SR00001. 14p. NTIS, PC A03/MF A01. Order Number DE89001412/JAW.

Reactor safety considerations in the New Production Reactor (NPR) program will take on additional importance in the aftermath of the Chernobyl accident. Characteristics of so-called "Inherently Safe Reactors" are likely to become relevant to the future NPR program. This memorandum briefly reviews these characteristics and discusses their applicability to a few NPR candidates. 4 refs., 3 figs.

56627 **(DPST—86-703) On the solute concentration in SSS storage tanks: Basis for $Gd(NO_3)_3$ {center←dot} $6H_2O$ concentration requirement in 100 area technical standard 3.04.** Parks, P.B. (Savannah River Lab., Aiken, SC (USA)). 1 Oct 1986. Contract AC09-76SR00001. 10p. NTIS, PC A02/MF A01. Order Number DE89000465/JAW.

The value of 0.34 gm/cm³ for the minimum ink solute concentration is devised to protect the validity of the current applicable, generic Confinement Protection Limit (CPL) calculations. These CPL's are based on AA3 code accident calculations that use a table of measured Δk/sub eff/'s versus time following an ink injection triggered by the Automatic Backup Shutdown - Safety Computer (ABS-S/C) system. The measured ink worth versus time is based on a test of the SSS system that occurred in January 1975. An analysis of the available data has established that the ink solute concentration during the 1975 test was 0.34 gm/cm³ (best estimate) within an uncertainty of +-0.07 gm/cm³. No greater accuracy in this estimate is necessary because the ink worth during the important early phases of postulated accidents is rather insensitive to the ink solute concentration. Calculations have shown that a 25% reduction in the solute concentration will cause only a 2% reduction in the ink worth at times less than 10--15 seconds after the SSS is triggered. Current procedures for mixing the ink will generate a solute concentration between 0.35 and 0.37 gm/cm³. A previous recommendation to change the procedure by which ink is mixed to allow an acceptance band between 0.37 and 0.53 gm/cm³ is consistent with setting the Technical Standard minimum at 0.34 gm/cm³. 8 refs., 3 tabs.

56628 **(EGG-M—01588) Limitations of probabilistic risk assessment for evaluating generic safety issues.** Reilly, H.J.; Cathey, N.G.; Agrawal, B. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 9p. (CONF-881014—7). NTIS, PC A02/MF A01. Order Number DE88016944/JAW.

From International European Nuclear Society/American Nuclear Society meeting on thermal reactor safety; Avignon, France (2 Oct 1988).

The US Nuclear Regulatory Commission (NRC) continues to support research leading to resolutions of generic safety issues (GSIs) that have been identified by its management systems. In one research effort, the Idaho National Engineering Laboratory (INEL) developed personal computer-based programs capable of assisting in GSI resolutions. These programs provide a low cost, standard means of performing probabilistic risk assessment (PRA) calculations, which determine the values (e.g., the averted risks) of proposed GSI resolutions. In conjunction with the development of these computer programs, INEL has researched the limitations of PRA analysis for evaluating GSIs. This research consisted of performing an issue by issue review of each GSI that has been identified by the NRC, in order to provide answers to a list of standard questions concerning each GSI. 3 refs., 4 figs.

56629 **(EGG-M—88259) INEL engineering simulation center.** Laats, E.T.; Makowitz, H.; Rittenhouse, D.L.; Venhuizen, J.R.; Burtt, J.D.; Bannister, D.G.; Beelman, R.J.; Mortensen, G.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 10p. (CONF-8810157—1). NTIS, PC A02/MF A01. Order Number DE88015176/JAW.

From 4. international science and engineering symposium on cray supercomputers; Minneapolis, MN, USA (12 Oct 1988).

The INEL Engineering Simulation Center was established in April 1988. The goal is to provide a modern, flexible, state-of-the-art simulation facility by unifying the computational simulation hardware and software, the experimental hardware, and the many years of related staff expertise at the Idaho National Engineering Laboratory (INEL). These capabilities have been developed over the past 35 years while designing, building and testing some 52 nuclear reactors at the INEL for the US Government. These hardware and software technologies are being merged to develop "first-of-its-kind" simulation capabilities. The initial applications of these capabilities are being focused on two areas. First, recent events in the nuclear industry are demanding that the technical community pursue a higher degree of realism from nuclear power plant training simulators within their current limits of applicability, and also that their limits of applicability be extended to simulate severe accident scenarios. This tool will greatly augment the training of plant operators in the recognition and mitigation of accidents. Second, to support the operator in making the most appropriate decisions under extreme stress, emphasis is also being placed on developing techniques that reduce the operator's burden when responding to an event. 6 refs., 3 figs., 1 tab.

56630 **(EGG-M—88315) Regulatory and technological insights from the US industry severe accident program and NRC interactions on severe accident issues.** Buhl, A.R.; Fontana, M.H.; Carter, J.C.; Mitchell, H.A. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 10p. (CONF-881014—5). NTIS, PC A02/MF A01. Order Number DE88016949/JAW.

From International European Nuclear Society/American Nuclear Society meeting on thermal reactor safety; Avignon, France (2 Oct 1988).

The technical foundation and process developed by the US nuclear industry to identify and resolve severe accident issues has the potential to greatly influence the certification of advanced light water reactors (ALWRs). Many of the insights gained from the Industry Degraded Core Rulemaking (IDCOR) Program are relevant and are an important part of the experience base that is being utilized in the design of advanced light water through the DOE sponsored Advanced Reactor Severe Accident Program (ARSAP). Key elements of the IDCOR Program are being extended by ARSAP. In particular, the improvements to the accident analysis code, MAAP, are being directed toward the few remaining issues that were not completely resolved by the US Nuclear Regulatory Commission (NRC) and IDCOR. In addition, insights from the development of system analysis methods and individual plant examinations are identifying plant vulnerabilities in existing plant designs. These improvements are reflected in severe accident requirements which ARSAP has provided to the Electric Power Research Institute (EPRI) ALWR Requirements Document. As a result, improvements in plant designs and operating procedures are being made in advanced light water reactor designs. 22 refs., 1 fig.

56631 **(EPRI-NP—6050) BWR top-guide integrity: Further evaluation: Final report.** Gerber, T.L.; Kuo, A.Y. (Electric Power Research Inst., Palo Alto, CA (USA); Structural Integrity Associates, San Jose, CA (USA)). Oct 1988. 46p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89000562/JAW.

An earlier analytical study of the potential significance of Irradiation Assisted Stress Corrosion Cracking (IASCC) of the BWR top guide structure showed that rather large cracks could be developed before beam failure would be predicted during a seismic event. Further, it was concluded that multiple beam failures would need to be shown as a credible failure mode for top guide IASCC to be a significant safety issue. Further analytical evaluations described in this report show that multiple beam failure is not credible when material toughness properties as a function of irradiation are taken from data in the open literature. On the other hand, if lower toughness properties are assumed, the linear elastic fracture mechanics analysis shows that only very small IASCC cracks can be tolerated and multiple beam failures are a possibility. Examination of numerous conservative assumptions inherent in the analysis methods suggests that refined analysis methods would show considerably more IASCC crack tolerance. 3 refs., 19 figs.

56632 **(GKSS—88/E/18) Studies on plant dynamics of sodium-cooled fast breeder reactors - verification of a plant model.** Schubert, B. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Anlagentechnik). (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.); Technische Univ. Braunschweig (Germany, F.R.). Fakultaet fuer Maschinenbau und Elektrotechnik; GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Anlagentechnik). 1988. 164p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88755157/JAW.

For the analysis of sodium-cooled FBR safety and dynamics theoretical models are used, which have to be verified. In this report the verification of the plant model SSC-L is conducted by the comparison of calculated data with measurements of the experimental reactors KNK II and RAPSODIE. For this the plant model is extended and adapted. In general only small differences between calculated and measured data are recognized. The results are used to improve and complete the plant model. The extensions of the plant model applicability are used for the calculation of a loss of heat sink transient with reactor scram, considering pipes as passive heat sinks. (orig./HP) With 69 figs., 10 tabs.

56633 **(IAE—4479/3) Nuclear power safety and efficiency: criteria, ways for improvement.** Legasov, V.A.; Novikov, V.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1987. 13p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703507/JAW.

Experience in NPP operation manifested that so far dominating views on nuclear power engineering (NPE) safety are too optimistic. Safety and economic efficiency are the factors setting back advance in NPE. As NPP accidents may have international aftereffects, safety standards must be formulated taking into account the expected scale of the world NPE development. Analysis of characteristic scenaries of NPE development shows that two stages of NPE safety may be outlined. At first stage (up to 2000 year) the present day reactors, for which a program of safety improvement is realized, form the basis; at the second stage design and production of a more safe reactor of new generation are necessary. Physical causes of maximum design basis accidents and the ways of their blocking or prevention are considered. This permits to formulate criteria forming the basis for concept of a more safe reactor of a new generation. Development of this concept have well-defined stages. Attention is paid to extention of accessible level of a new-generation reactor safety to all elements of NPE external fuel cycle. 6 refs.; 3 figs.

56634 (INIS-mf—11311, pp 13) **Calculation of the cloud gamma dose equivalents from NPP's accidental release.** Stubna, M.; Pokorny, V. (Nuclear Power Plants Research Institute, Trnava (Czechoslovakia)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

56635 (INIS-mf—11823) **Safety-reductions in cut-price nuclear power plant for export.** (Institut fuer Angewandte Oekologie, Darmstadt (Germany, F.R.). Projektgruppe Reaktorsicherheit). Nov 1985. 45p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755286/JAW.

Werkstattreihe.; no. 24.

The report concentrates on insufficiencies and defects in safety engineering in the KWU pressurised water reactor of the 1000 MW category, which is made for export. The study was carried out in the light of the impending export of such a PWR to Egypt, but it could be applied to other potential buyer countries in many aspects.

56636 (IWGFR—65) **Fast breeder reactor-block antiseismic design and verification: Proceedings.** Martelli, A.; Forni, M. (eds.). (International Atomic Energy Agency, Vienna (Austria). International Working Group on Fast Reactors). Feb 1988. 535p. (CONF-8710379—). NTIS (US Sales Only), PC A23. Order Number DE89000243/JAW.

From Specialists' meeting on fast breeder reactor-block antiseismic design and verification; Bologna, Italy (12 Oct 1987).

The Specialists' Meeting on Fast Breeder Reactor-Block Antiseismic Design and Verification was organized by the ENEA Fast Reactor Department in co-operation with the International Working group (IWGFR) of the International Atomic Energy Agency (IAEA), according to the recommendations of the 19th IAEA/IWGFR Meeting. It was held in Bologna, at the Headquarters of the ENEA Fast Reactor Department, on October 12-15, 1987, in the framework of the Celebrations for the Ninth Centenary of the Bologna University. A detailed seismic analysis of vessels and reactor - block internals appeared necessary to the LMFBR designers of most countries: such analysis implied the development of sophisticated numerical techniques and the organization of complicated and expensive experiments (for instance, non-linear computer programs and very detailed numerical models, as well as tests on prototypes of shutdown systems, prototypes or complete models of core elements and large core mock - ups, component tests, on - site tests). As a consequence, it appeared desirable to compare the design philosophies adopted in the various countries and to analyse the respective numerical and experimental methods and results, in order to define the state-of-the-art on the subject. Furthermore, it was obviously judged of interest to discuss future R & D programmes and to verify the possibility of extending the already existing co-operations.

56637 (Juel-Spez—425) **Improved process for calculating the probability of being hit by crashing aircraft by the Balfanz-model.** Hennings, W. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Sicherheitsforschung). Jan 1988. 25p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755182/JAW.

For calculating the probability of being hit by crashing military aircraft on different buildings, a model was introduced, which has already been used in the conventional fields. In the context of converting the research reactor BER II, this model was also used in the nuclear field. The report introduces this model and shows the application to a vertical cylinder as an example. Compared to the previous model, an exact and also simpler solution of the model attempt for determining the shade surface for different shapes of buildings is derived. The problems of the distribution of crashes given by the previous model is treated via the vertical angle and an attempt to solve these problems is given.

56638 (KWU-R—914/84/005) **Evaluation of some measures to reduce the consequences of release category II sequency. Final report.** Hassmann, K.; Beyer, H.; Czech, J.; Dressler, E.; Gossler, P.; Schmaltz, H.; Wuenschmann, D.; Albrecht, H.; Bunz, H.; Hosemann, J.P. (Kraftwerk Union A.G., Erlangen (Germany, F.R.). Reaktorentwicklung; Bundesministerium des Innern, Bonn (Germany, F.R.)). Mar 1984. 88p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755189/JAW.

On the basis of KONVOI-data the consequences of a hypothetical melt down sequence initiated by total loss of on and off site power and simultaneous failure of containment isolation according to a cross section of 300 cm/sup 2/ has been analysed. This corresponds to a leakage via the ventilation system (its isolation has been found to be highly reliable) or via a leak in the steel shell generated during the very first pressure peak. In case of a large leakage occuring very early in the accident the fission product source term will be reduced drastically if additional volumes are available for retention of fission products. (orig.) With 12 refs., 5 tabs., 14 figs.

56639 (LA-UR—88-2631) **Uncertainty in LOCA [loss-of-coolant accident] analysis historical discussion.** Sullivan, L.H. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 15p. (CONF-8808131—1). NTIS, PC A03/MF A01. Order Number DE88016335/JAW.

From Appendix K relief using best estimate method; Cambridge, MA, USA (11 Aug 1988).

The Nuclear Regulatory Commission (NRC) Commissioners approved the proposed change to 10 CFR Part 50 Appendix K in July 1988. The change allows reactor vendors to use either the previous Appendix K requirements or a best-estimate analysis with defined uncertainties. This change to Appendix K has led NRC to investigate and the nuclear industry to develop an acceptable method to evaluate the uncertainty in design-base thermal-hydraulic codes. Uncertainty methods suitable for the design-base codes have been investigated by both the NRC and nuclear industry since the late 1970's. This early work provides a good base for the current work and will allow the nuclear industry to use the advantages that the recently approved change to Appendix K offers. 11 refs., 2 figs., 6 tabs.

56640 (NUREG—0654-Rev.1-Supp.1) **Criteria for preparation and evaluation of radiological emergency response plans and preparedness in support of nuclear power plants: Criteria for utility offsite planning and preparedness: Final report.** Podolak, E.M. Jr.; Sanders, M.E.; Wingert, V.L.; Donovan, R.W. (Nuclear Regulatory Commission, Washington, DC (USA); Federal Emergency Management Agency, Washington, DC (USA)). Sep 1988. 34p. (FEMA-REP—1-Rev.1-Supp.1). NTIS, PC A03/MF A01 - GPO. Order Number TI89000004/JAW.

The Nuclear Regulatory Commission (NRC) and the Federal Emergency Management Agency (FEMA) have added a supplement to NUREG-0654/FEMA-REP-1, Rev. 1 that provides guidance for the development, review, and evaluation of utility offsite radiological emergency response planning and preparedness for those situations in which state and/or local governments decline to participate in emergency planning. While this guidance primarily applies to plants that do not have full-power operating licenses, it does have relevance to operating nuclear power plants.

56641 (NUREG—0844) **NRC integrated program for the resolution of Unresolved Safety Issues A-3, A-4 and A-5 regarding steam generator tube integrity: Final report.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Sep 1988. 150p. NTIS, PC A07/MF A01 - GPO. Order Number TI89000472/JAW.

This report presents the results of the NRC integrated program for the resolution of Unresolved Safety Issues (USIs) A-3, A-4, and A-5 regarding steam generator tube integrity. A generic risk assessment is provided and indicates that risk from steam generator tube rupture (SGTR) events is not a significant contributor to total risk at a given site, nor to the total risk to which the general public is routinely exposed. This finding is considered to be indicative of the effectiveness of licensee programs and regulatory requirements

for ensuring steam generator tube integrity in accordance with 10 CFR 50, Appendices A and B. This report also identifies a number of staff-recommended actions that the staff finds can further improve the effectiveness of licensee programs in ensuring the integrity of steam generator tubes and in mitigating the consequences of an SGTR. As part of the integrated program, the staff issued Generic Letter 85-02 encouraging licensees of pressurized water reactors (PWRs) to upgrade their programs, as necessary, to meet the intent of the staff-recommended actions; however, such actions do not constitute NRC requirements. In addition, this report describes a number of ongoing staff actions and studies involving steam generator issues which are being pursued to provide added assurance that risk from SGTR events will continue to be small. 146 refs., 5 figs., 11 tabs.

56642 (NUREG—0936-Vol.7-No.2) **NRC regulatory agenda: Quarterly report, April--June 1988.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services). Aug 1988. 95p. NTIS, PC A06/MF A01 - GPO. Order Number TI89000289/JAW.

The NRC Regulatory Agenda is a compilation of all rules on which the NRC has proposed or is considering action and all petitions for rulemaking which have been received by the Commission and are pending disposition by the Commission. The Regulatory Agenda is updated and issued each quarter.

56643 (NUREG/CP—0086-Vol.2, pp 618-626) **Design applications for proposed new source terms.** Eble, R.G. Jr. (Duke Power Co., Charlotte, NC (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

In October, 1985, the revised Source Terms Application Task Force was formed at Duke Power Company to review potential applications for the numerous government and industry source term research programs. These programs all indicate that radioisotopic releases from severe light water reactor power plant accidents are chemically different and mostly lower than previously predicted. The near term potential applications of this information include reducing or grading Emergency Planning actions and improving public perception of nuclear power plant safety, eliminating or reducing in-plant radiation environments for equipment qualification and post-accident personnel access and redesign of systems and hardware in the plant to more effectively reduce expected radioisotopic releases. The purpose of this paper is to review the preliminary analysis performed for Duke Power's Catawba Nuclear Station to determine potential impact of new source term methods on gamma radiation equipment qualification inside containment and in air filtration systems. The analysis includes: (1) selection of PRA sequences for the specific source term application; (2) use of the MAAP computer code to distribute sources inside containment; (3) new approaches for modeling containment to apply source term forms; and (4) buildup of radioisotopes on air filtration system filters.

56644 (NUREG/CP—0086-Vol.2, pp 627-635) **Control room habitability study - findings and recommendations.** Driscoll, J.W. (Argonne National Lab., Idaho Falls, ID (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

The Advisory Committee on Reactor Safeguards (ACRS) has raised a number of concerns related to control room habitability and has recommended actions which they believe could alleviate these concerns. As a result of the ACRS's concerns, the US Nuclear Regulatory Commission's (NRC) Office of Nuclear Reactor Regulation (NRR) in conjunction with the Offices of Research and Inspection and Enforcement, and the NRC regional offices, embarked upon a program to reevaluate Control Room Habitability. Argonne National Laboratory was contracted by the NRC to perform a Control Room Habitability Study on twelve licensed power reactors. The plants selected for the study were chosen based upon architect engineer, nuclear steam system supplier, utility, and plant location. The major findings of this study are included in this report along with generic recommendations of the review team that apply to control room HVAC systems. Although the study is not complete, at the time of publication of this report, the results obtained to date should be useful to persons responsible for Control Room Habitability in evaluating their own systems.

56645 (NUREG/CP—0086-Vol.2, pp 636-644) **Capture of iodine in suppression pools.** Owczarski, P.C.; Winegardner, W.K. (Pacific Northwest Lab., Richland, WA (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

The effectiveness of boiling water reactor pressure suppression pools in capturing airborne iodine species was investigated. A computer code was used to simulate the scrubbing of particulate iodide, vapor elemental iodine, and vapor organic iodides. For a typical postulated severe core damage accident sequence, suppression pools were effective scrubbers of elemental iodine if the pool was alkaline or dilute in iodine and of particles > 1.5 μM mass median diameter. Little scrubbing of organic iodide species occurred. An absorption model shows that elemental iodine can be absorbed by wet alkaline droplets before the droplets encounter the suppression pool. Thus, the iodine removal effectiveness of the pools is likely to be controlled by particle scrubbing.

56646 (NUREG/CP—0086-Vol.2, pp 645-662) **Absorption of airborne molecular iodine by water sprays.** Albert, M.F.; Wichner, R.P.; Baumgarten, P.K. (Oak Ridge National Lab., TN (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

A computer model, I2WASH, which accounts for the effect of hydrolysis reactions between molecular iodine and water, has been developed to predict the rate of removal of gaseous molecular iodine by water sprays. Hydrolysis reactions are known to affect the concentration driving force of mass transfer for molecular iodine absorption. Thus, factors that affect the hydrolysis kinetics, such as spray solution pH, iodine concentration, and temperature, should be considered in the design of a well-based absorption model. The described model also includes the effects of spray drop-size distribution, convective heat transfer, droplet evaporation or water condensation, decay heating, and ventilation air flow through the containment. The model was originally developed at Oak Ridge National Laboratory in 1985 for the Nuclear Regulatory Commission's Severe Accident Sequence Analysis program and has been improved to assist in a comprehensive probability risk assessment of the Savannah River Plant. Results obtained using the model are compared with those of the Containment Systems Experiments conducted at Pacific Northwest Laboratories in 1970. An improvement over the earlier model is indicated at room temperatures, but accuracy decreases as the temperature rises.

56647 (NUREG/CP—0086-Vol.2, pp 663-673) **Lowering costs and enhancing safety with the NUCLEAR-KARLSRUHE filter system.** Ohlmeyer, M.; Stotz, W. (Kernforschungszentrum Karlsruhe GmbH (West Germany)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

The reasons which had led to the development of the NUCLEAR - KARLSRUHE filter system for radioisotope removal from aerosols in the event of a reactor accident are described from the point of view of the KfK as the operator of this system. The characteristic features of the filter system are presented, both for the version designed to retain radioiodine and for the version used as a HEPA filter. The filter system complies with the requirements made with respect to enhanced safety in the same way as with the aspects of economy. Potential applications of this system outside the nuclear engineering field are indicated.

56648 (NUREG/CP—0086-Vol.2, pp 674-684) **Simulation of ventilation networks: presentation of the safety code PIAF complementary with fluid mechanics codes.** Perdriau, P.; Raboin, S.; Mulcey, P.; Martin, G.; Pruchon, P. (SGN, Saint-Quentin-en-Yvelines (France)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

The response of a ventilation network to disturbances either mechanical or thermal is difficult to evaluate when the network becomes complex as is the case in nuclear power plants and other nuclear facilities. Several teams from the CEA GROUP have joined together to elaborate a computation code able to simulate the behavior of any classical ventilation network. Such a code allows the study of a ventilation system in its design stage, pointing out safety problems and helping to solve them; the basis model generated in the design stage may be used to follow the operating life of the system, up to dismantling. The code, called PIAF, solves the set of equations which simulate a ventilation network in steady state: the numerical network is composed of nodes connected with various components. The unknowns of such a problem are pressure and temperature at the nodes and flow rates in the links. The problem induces a weakly nonlinear system, that PIAF solves by an iterative matricial newtonian method. PIAF has been validated in several facilities in France for various mechanical disturbances: some of those validation cases are considered.

56649 (NUREG/CP—0086-Vol.2, pp 789-791) **Absorber bed failure due to fire suppression system water.** Flis, C. (Indiana and Michigan Electric Co., Bridgman, MI (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

Several adsorber bed failures at the Donald C. Cook Nuclear Plant have been caused by leakage of water fire suppression valves and by inadvertant actuation of automatic water fire suppression systems.

56650 (NUREG/CP—0086-Vol.2, pp 795) **Fire protection from a regulatory viewpoint.** Bellamy, R.R. (Nuclear Regulatory Commission, King of Prussia, PA (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

The suggestion that water sprays be included in the design of nuclear air cleaning systems to extinguish a carbon fire is found in Revision 0 to Regulatory Guide 1.52, Design, Testing and Maintenance Criteria for Atmospheric Cleanup Systems in Nuclear Power Plants, which was published in 1972. It was quickly realized that this was not the best solution to the problem. Simply stated, the problem is not an actual fire in the carbon, but a temperature rise that could result in desorption of adsorbed iodine, and removal of the impregnant. It was acknowledged that you could not put enough iodine on the carbon in most filter systems so that the iodine on the carbon could ignite the carbon. Consequently, Revisions 1 and 2 to Regulatory Guide 1.52 were issued and recognized this change in emphasis. Water sprays were no longer recommended, but a low flow air bleed system would suffice, with a flow at least 10% of design flow to dissipate any decay heat. This, however, is only the position of the government nuclear regulatory experts, and may not agree with the position of the nuclear insurers. In addition, it is now recognized that wetting of the carbon can lead to structural concerns with the carbon support structure. The stainless steel is subject to corrosion from the iodide present on the carbon as impregnant, and it is imperative that once carbon becomes wet for whatever reason, it be removed from the beds as soon as possible so that corrosion does not occur.

56651 (NUREG/CP—0086-Vol.2, pp 796) **Adsorber fires.** Mathewes, W. (Kraftwerk Union Aktiengesellschaft, Offenbach (West Germany)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

During normal plant operation the activated carbon filter Systems exhaust air from controlled areas of the nuclear power plant. The system to be dealt with is equipped with two 100% filter trains (= 2 x 17.500 m^3/h). The total carbon volume in the adsorbers amounts to V = 10 m^3, and the total carbon weight G = 5.000 kg. The activated carbon (8 - 12 mesh) satisfies ANSI/ASME N 509, being impregnated on the base of 1.5% calcium iodide. The air flow passing the adsorber is directed from the bottom to the top of the carbon bed. In each case (plant operation or shut down) the heat transport will be improved by venting the margins between the carbon particles if the amount of carbon fines is reduced to a minimum. Sufficient protection of carbon filters will be accomplished by closing the exhaust damper of the building area at risk thus preventing heat intake or accumulation of contaminants such as HCL or SO_2 originating from fire hazards outside of the system. Also avoiding the clogging of the intake surface of the filters by particles of soot. The capability of the adsorption of methyl iodide by the activated carbon shall be protected.

56652 (NUREG/CP—0086-Vol.2, pp 797-798) **Adsorber fires.** Holmes, W. (American Nuclear Insurers, Farmington, CT (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

The following conclusions are offered with respect to activated charcoal filter systems in nuclear power plants: (1) The use of activated charcoal in nuclear facilities presents a potential for deep-seated fires. (2) The defense-in-depth approach to nuclear fire safety requires that if an ignition should occur, fires must be detected quickly and subsequently suppressed. (3) Deep-seated fires in charcoal beds are difficult to extinguish. (4) Automatic water sprays can be used to extinguish fires rapidly and reliably when properly introduced into the burning medium. The second part of the conclusions offered are more like challenges: (1) The problem associated with inadvertent actuations of fire protection systems is not a major one, and it can be reduced further by proper design review, installation, testing, and maintenance. Eliminating automatic fire extinguishing systems for the protection of charcoal adsorbers is not justified. (2) Removal of automatic fire protection systems due to fear of inadvertent fire protection system operation is a case of treating the effect rather than the cause. On the other hand, properly maintaining automatic fire protection systems will preserve the risk of fire loss at acceptable levels while at the same time reducing the risk of damage presented by inadvertent operation of fire protection systems.

56653 (NUREG/CP—0086-Vol.2, pp 799) **Adsorber fires.** Kovach, J.L. (Nuclear Consulting Services, Columbus, OH (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

The author takes exception to the conclusions that tray-type or Type 3 activated charcoal beds of air-cleaning systems at nuclear power plants and other nuclear facilities are potential sources of deep-seated fires. Successful extinguishment of fires with small nitrogen purges in test facilities is noted. Limited experimentation of tray-type units does not support the probability of detection of fires or the ability to extinguish a fire with installed sprays.

56654 (NUREG/CP—0086-Vol.2, pp 814-819) **Charcoal testing dilemma.** Willis, C.A. (Nuclear Regulatory Commission, Washington, DC (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

The background to the present problem with the testing of nuclear grade charcoal is summarized. The source term issue and NRC policy constraints are addressed. The need for both resolution of immediate testing problems and a continuing quality assurance (QA) program are emphasized.

56655 (NUREG/CP—0086-Vol.2, pp 843-850) **Nuclear power and nuclear waste: what good are they?.** Ray, D.L. May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

This generation is an energy-using society, and all ways of producing electricity also produce waste. Most of the industrial world and some developing nations are committed to nuclear power and have not been deterred by Chernobyl. Nuclear power generation and planning in France, Belgium, Sweden, Switzerland, Finland, West Germany, Spain, Great Britain, and Japan are noted. Beneficial uses of nuclear science other than energy production are noted. Current and potential uses of nuclear materials now or at one time considered to be waste are discussed. Garbage is not always what it seems. Today's nuclear waste contains many of tomorrow's useful materials. Nuclear waste can be mined, but only if scientists have the will and the courage to look at it as a resource first, and dispose of it only when there is no more good in it.

56656 (NUREG/CP—0086-Vol.2, pp 852-862) **High-efficiency particulate air filter test activities at the Department of Energy.** Bresson, J.F. (Dept. of Energy, Albuquerque, NM (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

For the past 2 years, test activities at the three Department of Energy HEPA Filter Test Facilities (FTFs) have been conducted under a unified set of operating standards intended to help achieve consistency in test methods and test results. Reviews of test operations are conducted at each FTF annually, and technical support and guidance are provided on request. Round Robin tests are conducted twice a year to compare penetration and resistance test results among the three FTFs. The FTFs prepare summary test data twice a year, and the data is analyzed for trends with respect to ongoing quality of HEPA filters in nuclear facilities. Data and conclusions from both the Round Robin tests and semiannual reports are discussed, the latter without reference to specific manufacturers. The new DOE standards include provisions for consideration and approval of new test aerosols or test methods, under closely controlled change procedures. Progress in obtaining DOE approval for DOS as a new aerosol, and for the Alternative Test System (ATS) developed by, and reported on by the LANL, as an approved new test method are discussed, as are 2 significant changes in standard NE-F-3-43, related to (a) toxicology test alternatives, and (b) the test aerosol definition. Finally, the emergence of new, higher flow rated HEPA filters and Ultra Low Particulate Air (ULPA) filters will impact DOE's design, procurement, testing and use of HEPA filters in the near future.

56657 (NUREG/CP—0086-Vol.2, pp 863-889) **Operational evaluation of the high flow alternative filter test system.** Scripsick, R.C.; Smitherman, R.L.; McNabb, S.A. (Los Alamos National Lab., NM (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2). Contract W-7405-ENG-36.

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

An alternative to the current filter test system (Q107) used to test Size 4 (500 cubic feet per min rated flow) and larger nuclear grade high efficiency particulate air (HEPA) filters at DOE Filter Test Facilities (FTFs) has been developed. This new test system, called the High Flow Alternative Filter Test System (HFATS), has undergone a long-term operational evaluation at the Oak Ridge FTF (ORFTF) for: (1) comparison between HEPA filter penetration measurements made with the HFATS and with the Q107; (2) assessment of the HFATS' long-term routine operational performance in the FTF environment; and (3) determination of the potential operational impacts of the HFATS on the FTFs. The overall conclusion of the operational evaluation is that the HFATS is capable of performing well in the FTF environment and that the HFATS offers some important operational advantages relative to the Q107. Given the results of this study and a technical evaluation of the HFATS reported elsewhere the authors recommend that the DOE consider adoption of the HFATS as an approved filter test method.

56658 (NUREG/CP—0086-Vol.2, pp 890-904) **Limits of high-efficiency particulate air filter operation under high temperature conditions.** Briand, A.; Laborde, J.C.; Mulcey, P. (CEN/Saclay, Gif sur Yvette (France)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

High efficiency particulate air filters (HEPA) play an important part amongst the air cleaning systems in nuclear plants. It proves to be indispensable on grounds of nuclear protection and safety, to know the behavior and limit use conditions of these filters in accidental situations such as, for example, a rise in the temperature of the air to be filtered (case of a fire). The SIMOUN test rig, in operation at the Saclay Nuclear Center, simulates this type of accident situation. It operates on negative pressure and is capable of supplying 4000 m^3M/h of clean air at 400°C. This facility is fitted with a device which determines, in real time, the efficiency of the filter to be tested, via a sodium chloride aerosol for which the influence of the temperature on the size distribution has been previously studied. With the study performed with this test rig it is possible to assess the evolution, in case of fire, of certain characteristic values of the filters (decontamination factor, pressure drop, temperature of the filter components) and deduce from this, information of interest to all those concerned by the processing of waste gases in nuclear plants.

56659 (NUREG/CP—0086-Vol.2, pp 905-920) **Collection of aerosols in high efficiency particulate air filters.** Pratt, R.P.; Green, B.L. (United Kingdom Atomic Energy Authority, Harwell). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

The investigation of the performance of HEPA filters of both minipleat and conventional deep pleat designs has continued at Harwell. Samples of filters from several manufacturers have been tested against the UKAEA/BNF plc filter purchasing specification. No unexpected problems have come to light in these tests, apart from some evidence to suggest that although meeting the specification minipleat filters are inherently weaker in burst strength terms than conventional filters. In addition tests have been carried out to investigate the dust loading versus pressure drop characteristics of both designs of filters using a range of test dusts - ASHRAE dust, carbon black, BS 2831 No. 2 test dust and sodium chloride. In parallel with laboratory test work a more fundamental study on the effects of geometric arrangement of filter media within the filter frame has been carried out on behalf of the UKAEA by Loughborough University. The results of this study has been the development of a mathematical model to predict the dust load versus pressure drop characteristic as a function of filter media geometry. This has produced good agreement with laboratory test results using a challenge aerosol in the 1-5 μm size range. Further observations have been made to enhance understanding of the deposition of aerosols within the filter structure. The observations suggest that the major influence on dust loading is the depth of material collected in the flow channel as a surface deposition, and this explains the relatively poor performance of the minipleat design of filter.

56660 (NUREG/CP—0086-Vol.2, pp 921-932) **Evaluation of high capacity filters.** Terada, K.; McIntyre, J.A.; Stone, J.S. (Rockwell International, Golden, CO (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

High capacity HEPA filters have the potential of significant savings in facilities and operating costs. By requiring fewer filters for a given air flow, the cost of a new plenum planned for construction at Rocky Flats could have been reduced by $8,000,000 if these high capacity filters were used. Also, by replacing the current 1000 cfm filters with these new filters in existing plenums, it was estimated that annual savings of about $1,000,000 in energy costs arising from the lowered pressure drop could be achieved. As a result, a program was initiated to determine whether high capacity

filters could meet Rocky Flats qualifications imposed on filters used in plenums. Thus far twenty filters have been tested for filtration efficiencies and flow capacities. All had efficiencies which exceeded 99.97%. However, at 1" w.g. their flow capacities were all below 2000 cfm. Seven filters have been subjected to the Heated Air Test. Of these, only 2 met the Rocky Flats requirement of less than 3% penetration. However the sealants for neither of these filters was self extinguishing as required.

56661 (NUREG/CP—0086-Vol.2, pp 933-946) **High-efficiency filter in nuclear air cleaning.** Gilbert, H. May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

The paper treats the special relationship between the high-efficiency particulate air filter and the nuclear energy program. Discussed are the following topics: initial development of paper-made filtration medium, original high-efficiency filter and its combustibility, high-temperature high-efficiency filter, fire-resistant design, chemical corrosion in airstreams, water repellency of filter medium, sealants, gasketing, novel designs for increased capacity, filter testing, HEPA acronym, and government-industry committee for filter improvements.

56662 (NUREG/CP—0086-Vol.2, pp 947-966) **Development of glass-fiber high-efficiency particulate air filters of high structural strength on the basis of the establishment of failure mechanisms.** Ruedinger, V.; Ricketts, C.I.; Wilhelm, J.G.; Alken, W. (Kernforschungszentrum Karlsruhe GmbH (West Germany)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

Practical experience from routine operation in nuclear installations as well as extensive bench and laboratory testing proved the structural limits of HEPA filters to be very low thus demonstrating the need for improvement of their structural strength. Detailed analysis of the courses and modes of filter failure under the challenge of dry air at high velocities and ambient temperature, together with additional measurements, allowed the establishment of the dominating mechanisms of filter failure. Based on this information, the following three options for effective and economical improvements in filter structural limits exist: (1) an increase in the tensile strength of the filter medium; (2) an increase in the stability of the pack to prevent the swelling of individual pleats; and (3) an increase in the area moment of inertia of the separators and a decrease in the sharpness of their edges. By using a reinforced glass fiber filter medium, the structural strength of standard size HEPA filters was increased to 31 kPa with dry air and beyond 10 kPa with air at high humidity. Prototype filters built with standard glass-fiber media and separators with inclined corrugations exhibited failure pressures of approximately 50 kPa under high velocity airflows. The combination of both types of improvements, together with other measures, will soon lead to even higher HEPA-filter structural strength.

56663 (NUREG/CP—0086-Vol.2, pp 967-977) **Rigid truss-like separator as alternative to corrugated foil for high-efficiency particulate air filters.** Agnew, B. (Air Filtering Institute, Ranch Mirage, CA (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

Corrugated foil separators do not get high ratings with respect to most of the desirable performance criteria for HEPA filters. They have continued in use to the present due to their availability and economy. Now, however, a rigid truss-like separator has been developed which has none of the short-comings of corrugated foil and which due to modern high speed fabricating equipment, can be produced at similar cost. Also, the process for making HEPA filters using the new separators lends itself to automation, leading to additional savings.

56664 (NUREG/CP—0086-Vol.2, pp 1002-1018) **Performance evaluation of the air exhaust sampling and monitoring systems at the Bruce-A nuclear generating station.** Curtis, K.E.; Guest, A. (Ontario Hydro Research Div., Toronto (Canada)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

The Bruce-A plant consists of four 825 MWe CANDU nuclear generating units. Each unit has 2 ventilation exhausts; a nominally Contaminated exhaust and a nominally Non-Contaminated exhaust. Each exhaust stream is monitored continuously for radioiodine, for radioactive particulate and for noble gases. The monitors provide warning of increasing emissions (i.e., a control function) and also provide a measure of station emission performance. The monitor systems consist of a probe in the exhaust stream, a sample line about 20 m long, and the monitor itself. Standards for probe design are available and some guidelines for sample-line design can be extracted from published data. Little, if any, in-station performance data are available for sampling systems, although plateout of radioiodine and deposition of particulate have been the subject of much speculation and a little laboratory study. A major in-station study has been undertaken at Bruce-A to obtain relevant in-station data. By comparisons of the concentrations of iodine, methyl iodine, and uranine particulate found at various points in the system, it could be concluded that no loss of iodine, methyl iodine, or particulate occurred in the ~ 20 m line and that particulate material is sampled accurately even by a poorly designed probe mounted in a very poor location.

56665 (NUREG/CP—0086-Vol.2, pp 1019-1031) **Monitoring gaseous radioiodine at power reactors.** Mandler, J.W.; Duce, S.W.; Tkachyk, J.W.; Lee, J.Y.; Willis, C.A. (Idaho National Engineering Lab., Idaho Falls (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

Idaho National Engineering Laboratory (INEL) personnel perform programs and conduct research including sampling and measuring gaseous radioiodine at commercial nuclear power reactors for the Nuclear Regulatory Commission (NRC). This paper presents the methods that are currently used for radioiodine sampling and measurement, results of some of the measurements made at commercial light water power reactors (e.g., ^{131}I release rates, radioiodine species mixtures, sources of radioiodine within plants, and charcoal filter decontamination factors), and results of a current study to determine the magnitude of iodine plate-out on gaseous effluent sample lines.

56666 (NUREG/CP—0086-Vol.2, pp 1032-1055) **Review of monitoring, sampling, and analysis of airborne reactor effluents in post-accident concentrations.** Hull, A.P.; White, J.R. (Brookhaven National Lab., Upton, NY (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2). Contract AC02-76CH00016.

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Shortly after the onset of the accident on 3/28/79 at Unit 2 of the Three Mile Island Nuclear Power Station, the upper range capabilities of its real-time monitors for gaseous, radioiodine and particulate effluents to the atmosphere were exceeded. Subsequently, the NRC required extended range gaseous effluent monitors and an improved capability for the obtaining of frequent samples of radioiodines and particulates at the concentrations that would be anticipated in effluent streams under accident conditions. In 1983 an on-site post-implementation review of their installation and operation was initiated by the NRC Region I. The results from twenty such reviews indicate that the licensees have adopted a variety of approaches to meet the NRC's requirements ranging from the installation of completely new commercial modules to improvised additions to existing monitors and samplers. Some advantages and drawbacks of these various approaches are summarized.

56667 (NUREG/CP—0086-Vol.2, pp 1056-1094) **Preliminary dose assessment of the Chernobyl accident.** Hull, A.P. (Safety and Environmental Protection Div., Upton, NY (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

Early on April 26, 1986, a major accident occurred at Unit 4 or the Chernobyl nuclear power station in the USSR. The plume of airborne radioactive fission products from the accident was initially carried northwesterly toward Poland, thence northerly toward Scandinavia on April 26-29 and into Central Europe on April 29-30. It continued to spread and reached Japan and Korea on May 3 and the US on May 7. Reports of the levels of radioactivity in a variety of media and of external radiation levels were collected in the Department of Energy's Emergency Operations Center and compiled into a data bank. Portions of these and other data, which were obtained directly from official reports, have been utilized to make a preliminary assessment of the extent and magnitude of the external dose to individuals downwind from Chernobyl. Preliminary calculations indicate that the external collective dose equivalent to the population (approximately 1.75×10^8) in Scandinavia and Central Europe during the first year after the Chernobyl accident will be about 4×10^6 person-rem and that about half this population dose will be received by the smaller population (approximately 6×10^7) who were downwind or Chernobyl within the USSR during the accident and its subsequent releases over the following week.

56668 (NUREG/CP—0086-Vol.2, pp 1130-1138) **Diablo Canyon power plant guidelines for protection of carbon filters.** Ginter, W. (Pacific Gas & Electric Co., Avila Beach, CA (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

There has been a long standing concern regarding the protection of carbon filters in the HVAC industry. Few quantitative guidelines have been provided concerning the significance of carbon exposure to smoke, chemicals or fumes, nor have limiting exposure quantities been determined. However, many nuclear plant license provisions require testing following painting, fire or chemical release within a zone communicating with the ventilation/filtration system. At Diablo Canyon Power Plant (DCPP) the authors have investigated the reasons behind the requirements for testing carbon filters after exposure. One known reason for testing is that the carbon is susceptible to hydrocarbon contamination, thereby saturating the adsorption sites on the carbon. Advances have been made to minimize exposure of carbon by initiation of constraints and precautions of surveillance testing, routine maintenance work and unexpected use of the filtration system. The utilization of proactive plant personnel also provides for a better awareness and regard for the protection of these filters. DCPP has taken a progressive approach to quantify and identify threshold exposure limits which are based on engineering judgment, conversations with air filtration experts associated with the nuclear industry and also with representatives of the NRC.

56669 (NUREG/CP—0086-Vol.2, pp 1148-1160) **Filter testing experience.** Paschal, W.B.; McQueen, D.L. (Sargent & Lundy, Chicago, IL (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

Completing the requisite ANSI N510 acceptance testing program on any project requires a team effort between the testing contractor, the owner, and the station designer. On a large multi-unit project with several ventilation systems serving both units and built-up filter systems in addition to the packaged filter units, team effort is paramount in achieving a successful program. This paper discusses several of the administrative and technical problems encountered during the successful execution of the ANSI N510 in-place testing program. The paper also reviews the ANSI N510 acceptance testing program requirements and provide an example of how these requirements were successfully implemented. It also reviews several of the challenging technical problems and solutions encountered. These included an interim testing, adjusting, and balancing (TAB) plan, TAB concepts, system operating combinations, the balancing of multiple plenum filter systems and plenum bypass leakage. The project is a twin 1100-MW pressurized water reactor electrical generating station. All HVAC systems process approximately 600,000 CFM through both package and built-up atmospheric cleanup filter units with final filtration consisting of HEPA filters and charcoal adsorbers.

56670 (NUREG/CP—0086-Vol.2, pp 1161-1172) **How small problems become big ones, or why do we test NATS?.** Jacox, J.W. (Jacox Associates, Columbus, OH (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

The purpose of the paper is to highlight the serious implications that can arise from an accumulation of small problems, and how this situation can help define improved, in-depth nuclear air treatment systems (NATS) testing. It is the intent to assist nuclear power plant upper management, as well as the technical staff, in understanding the rationale for a comprehensive Test Program (Acceptance and Surveillance) and for prompt remedial action on problems discovered. Particular attention is directed to problems that do not cause formal failure of a test series, but are subsidiary problems found during the performance of the test series.

56671 (NUREG/CP—0086-Vol.2, pp 1174) **Circular filter bag change ladderack system video presentation.** Stewart, B.L. (United Kingdom Atomic Energy Authority, Harwell). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

A great deal of research and development at Harwell over the last few years has centered around the design of circular radial flow HEPA filters as alternatives to the traditional rectangular HEPA filter. With a circular insert there are inherent features which give this geometry certain advantages over its counterpart, such as ease of sealing, compatibility with remote handling and disposal routes; these have been well publicized in previous works. A mock-up is shown of a bag change ladderack system of $3400 m^3/h$ circular filter. It highlights the space requirements for bag changing and demonstrates the ease with which a filter may be replaced. The filter throat incorporates a silicone rubber lip seal which forms a flap seal against a tapered spigot feature built into the wall. The novelty of this filter design is that the bag is an integral part of the filter and is attached onto the filter flange. This enables the inside of the filter, where the contamination particulate has collected, to be sealed/bagged off and hence the dust burden retained.

56672 (NUREG/CP—0086-Vol.2, pp 1176-1185) **Parametric relationships in gas desorption.** Jonas, L.A.; Walker, B.E.; Thompson, J.K. (Hughes Associates, Inc., Wheaton, MD (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

A study was made of the gas desorption characteristics of six solvents from an ASC whetlerite activated carbon. It was found that for each gas the time at which the peak desorbing concentration occurred, as well as the absolute value of the peak concentration, was an exponential function of the gas loading on the bed. The greater the gas loading the shorter the time required for the peak concentration occur and the higher the absolute value of the peak concentration. A logarithmic relation was found to exist between the peak desorbing concentration and the throughput parameter (number of times the carbon volume was swept through by an equal volume of air). In general, the ease of desorption was correlated with the weakness of the gas-carbon adsorption bond.

56673 (NUREG/CP—0086-Vol.2, pp 1186-1188) **Experience with temporary carbon filters to reduce airborne iodine in a containment during an outage.** Edwards, J.R. (Charcoal Service Corp., Bath, NC (USA)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

Workers in containment are more efficient, less stressed, and require less support such as track times and respirator restoration when they do not wear respirators. In an effort to cut outage labor costs associated with the use of respirators, some utilities have installed temporary carbon filters on the intake of their containment air recirculation fans. The purpose of the filters is to reduce and keep airborne iodine levels below the level which requires the use of respirators. The use of such filters has proved successful when the iodine level is lower, and not as successful when the iodine level is higher.

56674 (NUREG/CP—0086-Vol.2, pp 792-794) **Fires in nuclear power plants and their influence on the retention of radioiodine by iodine filters.** Deuber, H.; Giraud, V. (KFK-LAF, Karlsruhe (West Germany)). May 1987. NTIS, PC A99/MF A01 - GPO. Order Number TI88015222/JAW. (CONF-860820—Vol.2).

From 19. DOE/NRC nuclear air cleaning conference; Seattle, WA, USA (18 Aug 1986).

Important aspects are summarized of fires in nuclear power plants (light water reactors) and their influence on the retention of radioiodine by iodine filters. Fires in iodine filters are beyond the scope of the paper.

56675 (NUREG/CR—4914) **The influence of selected containment structures on debris dispersal and transport following high pressure melt ejection from the reactor vessel.** Pilch, M.; Tarbell, W.W.; Brockmann, J.E. (Nuclear Regulatory Commission, Washington, DC (USA); Sandia National Labs., Albuquerque, NM (USA)). Sep 1988. Contract AC04-76DP00789. 96p. (SAND—87-0940). NTIS, PC A05/MF A01 - GPO. Order Number TI89001074/JAW.

High pressure expulsion of molten core debris from the reactor pressure vessel may result in dispersal of the debris from the reactor cavity. In most plants, the cavity exits into the containment such that the debris impinges on structures. Retention of the debris on the structures may affect the further transport of the debris throughout the containment. Two tests were done with scaled structural shapes placed at the exit of 1:10 linear scale models of the Zion cavity. The results show that the debris does not adhere significantly to structures. The lack of retention is attributed to splashing from the surface and reentrainment in the gas flowing over the surface. These processes are shown to be applicable to reactor scale. A third experiment was done to simulate the annular gap between the reactor vessel and cavity wall. Debris collection showed that the fraction of debris exiting through the gap was greater than the gap-to-total flow area ratio. Film records indicate that dispersal was primarily by entrainment of the molten debris in the cavity. 29 refs., 36 figs., 11 tabs.

56676 (NUREG/CR—4935) **Closeout of IE bulletin 85-02: Undervoltage trip attachments of Westinghouse DB-50 type reactor trip breakers.** Foley, W.J.; Dean, R.S.; Hennick, A. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Operational Events Assessment; Parameter, Inc., Elm Grove, WI (USA)). Sep 1988. 34p. (PARAMETER/IE—170). NTIS, PC A03/MF A01 - GPO. Order Number TI89001009/JAW.

Documentation is provided in this report to close out IE Bulletin 85-02 on the subject of undervoltage trip attachments (UVTAs) of Westinghouse DB-50 Type reactor trip breakers (RTBs). The bulletin was issued to require the owners of Westinghouse operating power reactors to provide assurance that their DB-50 Type RTBs with UVTAs were operating properly, unless they had implemented the automatic shunt trip modification. Review of utility responses and NRC documents shows that the concern about unmodified RTBs applied to eight facilities. Evaluation of utility responses and NRC/Region inspection reports shows that reliability of UVTAs at these eight facilities is ensured by means of procedures, tests and schedules. Furthermore, the NRC regions verify that the recommended automatic shunt trip attachment has been or will be implemented at these remaining eight facilities. Background information is supplied in the introduction and Appendix A of this report.

56677 (NUREG/CR—5086) **Platinum catalytic igniters for lean hydrogen-air mixtures.** Thorne, L.R.; Volponi, J.V.; McLean, W.J. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering). Sep 1988. Contract AC04-76DP00789. 37p. (SAND—88-8201). NTIS, PC A03/MF A01 - GPO. Order Number TI89000470/JAW.

We have developed a prototype catalytic igniter for lean hydrogen-air mixtures that could have important applications in nuclear reactor safety. The igniter has two useful characteristics related to these applications: it requires no electrical power and it can ignite mixtures as lean as 5.5% hydrogen. The ignition induction time ranges from 20 s to 400 s depending on the hydrogen concentration, gas flow velocity, gas temperature and relative humidity of the gas mixture. Induction times are shorter for mixtures with higher hydrogen concentrations, higher flow velocities, higher gas temperatures and lower relative humidity. The igniter operates successfully under conditions that may be present during a loss-of-coolant accident (LOCA) at a light water nuclear reactor. In the event of a LOCA, large quantities of hydrogen may be produced very rapidly and the catalytic igniter could provide a means of igniting it before dangerously high concentrations are attained; even in the event that electrical power required for conventional igniters is not available. The igniter has not been tested under all possible LOCA conditions. High gas velocities, water spray, steam and iodine-containing compounds may be present during a LOCA and will defeat the prototype igniter. However, shielding and semi-permeable coatings on the igniter could overcome these difficulties. A US Patent has been granted for the catalytic igniters described herein (US Patent No. 4,741,879). 14 refs., 10 figs., 2 tabs.

56678 (NUREG/CR—5109) **Relocation of metallic constituents in core debris beds.** Dosanjh, S.S. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; Sandia National Labs., Albuquerque, NM (USA)). Sep 1988. Contract AC04-76DP00789. 77p. (SAND—88-0535). NTIS, PC A05/MF A01 - GPO. Order Number TI89000080/JAW.

The MELPROG computer code is being developed to provide a mechanistic treatment of Light Water Reactor (LWR) accidents from accident initiation through vessel failure. This paper describes a two-dimensional (r-z) debris meltdown model that has been developed for use in the MELPROG code. Of interest in this study is melt progression in particle beds that can form in both the reactor core and the lower plenum during severe LWR accidents. The analysis includes mass conservation equations for each species. A two-dimensional (r-z) momentum equation accounts for melt relocation to both gravity and capillary forces; viscous drag is included by modifying Darcy's Law to account for undersaturated flow, and the wetting behavior of molten stainless steel in contact with UO_2 is modeled using the formulation suggested by Scheidegger. As solid melts in the center of the bed, the porosity increases; collapse of the bed is incorporated using a critical minimum solid volume fraction α/sub s,min/. The energy equation considers conduction and radiation heat transfer in the bed, and phase diagrams are used to model Fe-Zr and U-Zr-O interactions.

56679 (NUREG/CR—5162) **CHARM: A model for aerosol behavior in time varying thermal-hydraulic conditions.** Wheatley, C.J. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; Sandia National Labs., Albuquerque, NM (USA)). Aug 1988. Contract AC04-76DP00789. 152p. (SAND—88-0745). NTIS, PC A08/MF A01 - GPO. Order Number TI89000225/JAW.

CHARM is a computer model for the behavior of a one component aerosol in a single region with time-varying external conditions. It treats particle agglomeration due to Brownian motion, gravity, turbulence, thermophoresis and diffusiophoresis. Turbulence properties are estimated for flow through a region of

arbitrary cross-sectional shape; with aerodynamically rough or smooth walls at any Reynolds number. The gas can be of any composition. The time-varying external conditions allowed for are the temperature, pressure and velocity of the gas, wall temperatures, and the rate, mass median radius and geometric standard deviation of the source. The model is simply modified to enable this list to be extended if needed. A new method of solving the governing equations, based on the finite element collocation method, enables the time-varying conditions to be treated accurately and economically. The models, the numerical methods, the execution of the computer code (including how to write the input data file and interpret results), and how to make simple modifications to the model are described in detail. Model implementation as a submodel of a larger one and what further work needs to be done to enable it to efficiently treat multicomponent aerosols, and condensation onto and evaporation from particles are also discussed.

56680 **(NUREG/CR—5227) Fitness for duty in the nuclear power industry: A review of technical issues.** Barnes, V.; Fleming, I.; Grant, T.; Hauth, J.; Hendrickson, J.; Kono, B.; Moore, C.; Olson, J.; Saari, L.; Toquam, J.; Wieringa, D.; Yost, P.; Hendrickson, P.; Moon, D.; Scott, W. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor Inspection and Safeguards; Battelle Human Affairs Research Center, Seattle, WA (USA); Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 171p. (PNL—6652; BHARC—700/88/018). NTIS, PC A08/MF A01 - GPO. Order Number TI88017333/JAW.

This report presents information gathered and analyzed in support of the United States Nuclear Regulatory Commission's (NRC's) efforts to develop a rule that will ensure that workers with unescorted access to protected areas in nuclear power plants are fit for duty. The primary potential fitness-for-duty concern addressed in the report is impairment caused by substance abuse, although other sources of impairment on the job are discussed. The report examines the prevalence of fitness-for-duty problems and discusses the use and effects of illicit drugs, prescription drugs, over-the-counter preparations and alcohol. The ways in which fitness-for-duty concerns are being addressed in both public- and private-sector industries are reviewed, and a description is provided of fitness-for-duty practices in six organizations that, like the nuclear industry, are regulated and whose operations can affect public health and safety. Methods of ensuring fitness for duty in the nuclear industry are examined in detail. The report also addresses methods of evaluating the effectiveness of fitness-for-duty programs in the nuclear power industry.

56681 **(OEFZS—4433) Work in the field of thermohydraulics of VVER-440 in 1987 funded by the Austrian chancellor's office.** Sonneck, G.; Pfau, H. (Oesterreichisches Forschungszemtrum Seibersdorf G.m.b.H. Inst. fuer Energie- und Anlagentechnik). (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Feb 1988. 25p. (In German). (EA—310/88). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704052/JAW.

The work funded in 1987 is based on the IAEA Standard Problem Exercises (SPEs) 1 and 2: posttest analyses for SPE1 and pretest analyses for SPE2. Both exercises are based on experiments in the PMK-NVH loop built by KFKI in Budapest (Hungary), which simulates the thermal hydraulic behaviour of reactors of the VVER-440 type at small leaks. 5 refs., 11 figs.

56682 **(OEFZS—4435) Contributions to the reactor safety during 1987: fuel-rod and fission product behaviour.** Sdouz, G. (Oesterreichisches Forschungszemtrum Seibersdorf G.m.b.H. Inst. fuer Energie- und Anlagentechnik). (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Feb 1988. 22p. (In German). (EA—311/88). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704053/JAW.

This is a review of the Austrian contributions to the analysis of OECD-LOFT-Test LP-FP-1. In addition this work initiates a new field of interest: Fission Product Behaviour. It was necessary to investigate the theory and application of various fission product models. At last the 'Source Term Code Package' is described. 6 refs., 4 figs.

56683 **(PB—88-222088/XAB) Methodology for the assessment of risk of major fire loss in multi-unit turbine generator buildings. Technical report.** Holmes, W.D. (American Nuclear Insurers, Farmington, CT). 1984. 35p. NTIS, PC A03.

Risk-assessment techniques are frequently applied to nuclear power plants. To date, the main focus in the application of risk-assessment techniques has been in the area of nuclear safety. This paper applies risk assessment techniques in evaluating loss potential from a fire involving lube oil in the balance of the nuclear or non-nuclear generating plant. A technique is developed to compare the probability of a major fire loss for a fully-protected and non-protected facility and applies that technique to evaluate the change in loss potential for various changes in the total fire-protection system.

56684 **(PB—88-222781/XAB) Costing data for fire protection in complex industrial occupancies. Technical report.** Mowrer, D.S. (Professional Loss Control, Inc., Oak Ridge, TN (USA)). 1982. 17p. NTIS, PC A03.

The study covers two primary objectives related to fire protection in nuclear power plants: the develoment of realistic cost estimates for the installation of halon and water suppression systems, and the development of cost estimates for installation of passive fire barriers, including barrier-penetration seals. To obtain information for these objectives, contact was made with representatives of 21 operating nuclear power facilities and 21 vendors of equipment. Valid responses were received from 11 nuclear facilities and from 13 of the vendor sources. The conclusions do not represent a statistical analysis of reviewed data. Rather, the cost estimates proposed are heavily influenced by the subjective interpretation of the authors and are tempered by significant field experience. The figures quoted do, however, reflect sound engineering judement and can be used to estimate actual costs.

56685 **(PNL-SA—16069) Wall-thinning in nuclear piping, status and ASME Section XI activities.** Bush, S.H.; Chexal, B. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 14p. (CONF-880824—1). NTIS, PC A03/MF A01. Order Number DE89000397/JAW.

From International nuclear power plant aging symposium; Bethesda, MD, USA (30 Aug 1988).

Wall thinning due to wet steam is a well known phenomenon in both fossil and nuclear power plants; however, the widely reported wall thinning and failure of a feedwater line in the Surry Power Plant was quite unexpected because it occurred in single-phase liquid water. Since the Surry failure, wall thinning phenomenon has been reported in other nuclear plants, demonstrating single-phase erosion-corrosion to be a generic issue. Critical parameters influencing wall thinning in single-phase liquid water are: alloy composition of the pipe; degree of turbulence in a given location; pH level; oxygen content, linear flow velocity; and temperature. Other factors may influence rate of attack and type of attack; e.g., uniform wall thinning, slot-type attack, or highly localized wall thinning. The USNRC has requested action by the ASME Codes, specifically Section XI. This paper discusses the wall-thinning problem and current programs, particularly at EPRI aimed at its definition and resolution, and the proposed Section XI plan of attack. The Section XI plan is based on the maximum utilization of the available data generated by EPRI and by the USNRC. Section XI plans on covering nondestructive examination (NDE) related to where and how often to examine and with what tools; e.g., ultrasonics or radiography. In addition, the issue of wall-thinning evaluation analogous to flaw evaluation will be covered. It is hoped that there will be reduction in level of examination to partially compensate for the added requirements of NDE to detect wall thinning. 2 refs.

56686 **(SAND—88-0597C) ACRR [Annular Core Research Reactor] fission product release tests: ST-1 and ST-2.** Allen, M.D.; Stockman, H.W.; Reil, K.O.; Grimley, A.J.; Camp, W.J. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 11p. (CONF-881014—9). NTIS, PC A03/MF A01. Order Number DE88015694/JAW.

From International European Nuclear Society/American Nuclear Society meeting on thermal reactor safety; Avignon, France (2 Oct 1988).

Two experiments (ST-1 and ST-2) have been performed in the Annular Core Research Reactor (ACER) at Sandia National Laboratories (SNLA) to obtain time-resolved data on the release of fission products from irradiated fuels under light water reactor (LWR) severe accident conditions. Both experiments were conducted in a highly reducing environment at maximum fuel temperatures of greater than 2400 K. These experiments were designed specifically to investigate the effect of increased total pressure on fission product release; ST-1 was performed at approximately 0.16 MPa and ST-2 was run at 1.9 MPa, whereas other parameters were matched as closely as possible. Release rate data were measured for Cs, I, Ba, Sr, Eu, Te, and U. The release rates were higher than predicted by existing codes for Ba, Sr, Eu, and U. Te release was very low, but Te did not appear to be sequestered by the zircaloy cladding; it was evenly distributed in the fuel. In addition, in post-test analysis a unique fuel morphology (fuel swelling) was observed which may have enhanced fission product release, especially in the high pressure test (ST-2). These data are compared with analytical results from the CORSOR correlation and the VICTORIA computer model. 8 refs., 8 figs., 2 tabs.

56687 **(SAND—88-0656C) Mixing of isothermal and boiling molten-core jets with water: The initial conditions for energetic FCIs [fuel-coolant interactions].** Marshall, B.W. Jr.; Beck, D.F.; Berman, M. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1988. Contract AC04-76DP00789. 5p. (CONF-881014—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88008121/JAW.

From International European Nuclear Society/American Nuclear Society meeting on thermal reactor safety; Avignon, France (2 Oct 1988).

The purpose of research described in this paper is to begin to develop an understanding of the coarse-mixing behavior of jets of molten fuel falling through water. This knowledge will also be used in the development and assessment of the Integrated Fuel-Coolant Interactions (IFCI) computer code being developed at Sandia National Laboratories. Sandia's jet-mixing program currently consists of four series of experiments addressing the important issues of liquid-jet mixing. These four series are (1) jets of molten iron/alumina falling through air; (2) jets of water falling through air; (3) jets of molten iron/alumina falling through water (referred to as boiling-jet experiments); and (4) isothermal jets falling through water. This paper describes the results of the boiling (EJET) and isothermal (IJET) series, since these results are most applicable to reactor-safety issues.

56688 **(SAND—88-1258C) MELCOR analysis of the TMI-2 accident.** Boucheron, E.A.; Kelly, J.E. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 20p. (CONF-881024—4). NTIS, PC A03/MF A01. Order Number DE89001216/JAW.

From TMI-2 accident materials behavior, plant technology and recovery; Washington, DC, USA (30 Oct 1988).

The MELCOR computer code has been used to analyze the first 174 minutes of the TMI-2 accident. MELCOR is being developed at Sandia National Laboratories for the US Nuclear Regulatory Commission for the purpose of analyzing severe accidents in nuclear power plants. Comparison of the code predictions to the available data shows that MELCOR is capable of modeling the key events of the TMI-2 accident and reasonable agreement with the available data is obtained. In particular, the core degradation and hydrogen generation models agree with best-estimate information available for this phase of the accident. While the code uses simplified modeling, all important characteristics of the reactor system and the accident phenomena could be modeled. This exercise demonstrates that MELCOR is applicable to severe accident analysis. 6 refs., 7 figs., 2 tabs.

56689 **(SAND—88-2290C) Chemical processes in the reactor coolant system under accident conditions.** Elrick, R.M.; Powers, D.A. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1988. Contract AC04-76DP00789. 11p. (CONF-881014—4). NTIS, PC A03/MF A01. Order Number DE88015691/JAW.

From International European Nuclear Society/American Nuclear Society meeting on thermal reactor safety; Avignon, France (2 Oct 1988).

Uncertainty analyses of the potential revaporization of radionuclides in the reactor coolant system are presented. These results indicate deposited Cs, I, Te and to some extent Ru and Ba have significant probabilities of revaporizing from the reactor coolant system once the reactor coolant system has been breached and natural convection causes a flow from the reactor containment building through the coolant system. The magnitude of the revaporization depends critically on the chemical form of the deposited material. Experimental studies of CsI transport behavior in high temperature steam indicate CsI may decompose yielding a volatile form of iodine and leaving cesium bound to structural surfaces in a form substantially less volatile than CsI or CsOH. A factorial design test series considering the variables of flow velocity, surface area, cesium iodide-to-steam concentration ratio, and oxygen potential has been conducted to establish the kinetics of cesium iodide decomposition. A model of the kinetic processes is suggested. 14 refs., 4 figs., 2 tabs.

56690 **(SAND—88-2384C) Direct containment heating: Surtsey test results and models.** Tarbell, W.W.; Nichols, R.T.; Pilch, M.; Brockmann, J.E.; Powers, D.A. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1988. Contract AC04-76DP00789. 11p. (CONF-881014—10). NTIS, PC A03/MF A01. Order Number DE88016491/JAW.

From International European Nuclear Society/American Nuclear Society meeting on thermal reactor safety; Avignon, France (2 Oct 1988).

Direct containment heating is one of the processes that can lead to containment rupture early in a severe reactor accident. The origins and the current understanding of this process are surveyed. Three issues arise in connection with direct containment heating -- threats to containment integrity posed by transfer of energy to the containment atmosphere from dispersed core debris or the generation of hydrogen by reactions of core debris with steam, and the formation of radioactive aerosols available for release from the plant should containment integrity be lost. The two threats to containment integrity have different characteristics. Energy exchange between core debris and the atmosphere depends on the long range dispersal of the debris and the atmosphere depends on the long range dispersal of the debris and can be affected by interactions of the debris with structures and co-dispersed water. Hydrogen generation is dependent on the detailed flows of debris and steam within and near the reactor cavity. Results of four experiments in the Surtsey test facility to explore energy exchange with the atmosphere are presented. These experiments suggest "single particle" models of direct heating over-predict the threat to containment integrity and that debris/structure interactions can enhance heating of the containment atmosphere. Results of test to establish the low pressure cut-off to direct heating are reported. 23 refs., 2 figs., 1 tab.

56691 **(WHC-SA—0259) Operational safety experience and passive safety testing at the FFTF.** Baird, Q.L.; Rathbun, J.L.; Stepnewski, D.D.; Stover, R.L.; Waltar, A.E. (Westinghouse Hanford Co., Richland, WA (USA)). Mar 1988. Contract AC06-87RL10930. 30p. (CONF-8710279—2). NTIS, PC A03/MF A01. Order Number DE89000510/JAW.

From US/USSR joint committee meeting on experimental data and studies of core accident conditions; Argonne, IL, USA (21 Oct 1987).

The FFTF is a 400-MWt sodium-cooled fast neutron flux test reactor located on the US government-owned Hanford Site in southeastern Washington state. The reactor is operated for the US Department of Energy by the Westinghouse Hanford Company. Since FFTF started routine operation in 1982, the commercially fabricated driver fuel has performed flawlessly to well beyond the design goal peak burnup of 80 MWd/kgM. The core average discharge exposure is now some 60% beyond the original design expectations and attests to the ruggedness and reliability of the mixed oxide fuel system. In Cycle 9 sixteen long-life assemblies were installed to begin the irradiation of mixed oxides in the advanced low-swelling alloy HT-9 as the Core Demonstration Experiment

(CDE). Operation of the plant from initial startup testing to ten cycles of operation has confirmed that the nuclear characteristics are well within the design predictions, and all parameters have remained inside the operating envelope defined by the Technical Specifications. Valuable experience has been gained in the identification and location of FFTF fuel assemblies containing a breached pin. Since the reactor began full-power operation in 1981, ten experimental fuel pin breaches have occurred and all were successfully identified. The principal objectives of the combined FFTF natural circulation and Passive Safety Testing program were: (1) to verify natural circulation as a reliable means to safely remove decay heat, (2) to extend passive safety experience to a large-size LMR and obtain data for validating design analysis computer codes, and (3) to develop and test passive safety enhancements that might be used for future LMRs.

56692 **(WHC-SA—0285) Comparison of FFTF (Fast Flux Test Facility) feedback reactivities with SASSYS calculations in a loss-of-flow-without-scram event.** Nguyen, D.H. (Westinghouse Hanford Co., Richland, WA (USA)). Apr 1988. Contract AC06-87RL10930. 6p. (CONF-880506—25). NTIS, PC A02/MF A01. Order Number DE89000516/JAW.

From Safety of next generation power reactors; Seattle, WA, USA (1 May 1988).

The Cycle 8A static tests conducted in the Fast Flux Test Facility (FFTF) during 1986 have resulted in the separation of various feedback reactivity components. These feedback components, described by closed-form equations depending only on the reactor temperature field, can be regarded as database for the validation and/or calibration of feedback mechanistic models. The SASSYS safety analysis code contains the most developed feedback reactivity models and was selected for the comparison study between database and mechanistic calculations for the FFTF. Although detailed feedback models for control rod repositioning and core radial expansion/bowing exist, only the simple models were available in SASSYS at the time of this study. The results are described in this paper.

25 ENERGY STORAGE

REFER ALSO TO CITATION(S) 56372

2506 Thermal

REFER ALSO TO CITATION(S) 56806

56693 **(HAA—8105) Aquifer thermal energy storage demonstration project, phase 1. Final Report.** (Hooper and Angus Associates Ltd., Toronto, Ontario (Canada); Hydrology Consultants Ltd., Toronto, Ontario (Canada)). May 1981. 81p. (CE—01911). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This study has been concerned with assessing the feasibility of an aquifer thermal energy storage (ATES) demonstration project at an Ontario office building. The first objective of the project was to determine if an aquifer formation was located below the site and if so, to ascertain its suitability for thermal energy storage. A well was developed for the purpose of withdrawing groundwater during the testing phase. An observation well drilled nearby was used during the pump tests to record the local lowering of the water surface. Soil samples were taken from a third hole which was installed with four piezometers which permitted the observation of the water surface in the formation strata. The hydraulic characteristics of the aquifer were determined through a 24 h pump test. The testing and sampling program which was undertaken was successful as an overburden aquifer was identified beneath the site. It was found to consist of fine to medium sand located between the depth interval of 38 m to 48 m below grade. The hydraulic properties of the formation are considered to be favourable for the demonstration as withdrawal rates required for the cooling of the building can be sustained. The impact of the demonstration program on the building and the aquifer was assessed. The building heating and cooling loads were determined and the HVAC system described. It was concluded that, as the heating system is steam based, an aquifer based heating system should not be developed under this demonstration. However, as there are no perceived major technical barriers to the modification of the existing mechanical plant to suit an aquifer based cooling sytem, it was recommended that the storage of chilled water in this aquifer for building cooling be demonstrated. 5 refs., 42 figs., 8 tabs.

2508 Chemical

56694 **Shock-activated electrochemical power supplies.** Benedick, W.B.; Graham, R.A.; Morosin, B. US Patent Application 6-039,853. 20 Apr 1987. 18p. Contract AC04-76DP00789. NTIS, PC A03/MF A01.

A shock-activated electrochemical power supply is provided which is initiated extremely rapidly and which has a long shelf life. Electrochemical power supplies of this invention are initiated much faster than conventional thermal batteries. Power supplies of this invention comprise an inactive electrolyte and means for generating a high-pressure shock wave such that the shock wave is propagated through the electrolyte rendering the electrolyte electrochemically active. 2 figs.

2509 Batteries

REFER ALSO TO CITATION(S) 56694, 57242

56695 **(AD-A—194974/2/XAB) Photointercalating-semiconductor/solid-electrolyte junctions for storage and chemical detection. Phase 2. Final report, 1 October 1986-31 May 1988.** Sammells, A.F. (Eltron Research, Inc., Aurora, IL (USA)). 31 May 1988. 147p. NTIS, PC A07/MF A01.

The overall objective of this Phase II effort was to perform a scientific and technical characterization of photointercalating-semiconductor/solid-electrolyte junctions for photoelectrochemical energy storage, with emphasis being placed upon the Group IV dichalcogenides n-HfS_2 and n-ZrS_2 and their interface with solid polymer electrolytes. Also incorporated within the scope of this program was the application of insights gained towards novel approaches for chemical detection. Here, emphasis was placed upon surface acoustic wave (SAW) and multiple-reflecting optical-waveguide sensors for the reversible detection of SO_2.

56696 **(AD-A—194979/1/XAB) Aircraft battery state-of-charge and charge-control system. Final report, July 1984-June 1987.** Viswanathan, S.; Charkey, A. (Energy Research Corp., Danbury, CT (USA)). Jan 1988. 184p. NTIS, PC A09/MF A01.

This Final Report describes work done by Energy Research Corporation (ERC) in developing an aircraft-battery state-of-charge indicator and charge-control system. The basis for this system, developed by ERC, is a nickel-oxygen (NiO_2) pilot cell (0.374 Ah). This pilot cell is cycled in tandem with nickel-cadmium battery. The oxygen pressure of the pilot cell is used to determine and control the state-of-charge of the nickel-cadmium battery. Nickel-cadmium batteries from different manufacturers were cycled using this pilot-cell charge indication and control system.

56697 **(PNL-SA—16137) Sodium/metal chloride batteries: Summary of status.** Sen, R.K. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 17p. (CONF-8808137—1). NTIS, PC A03/MF A01. Order Number DE88015943/JAW.

From Wokshop on high-temperature batteries; Washington, DC, USA (16 Aug 1988).

In 1972, there was an effort underway at ESB to try to develop a sodium/antimony trichloride battery that would operate at 200{degree}C or less. These cells, like their sodium/sulfur counterpart, used beta alumina electrolyte tubes, but with a second component in the electrolyte, namely molten sodium tetrachloroaluminate. The latter was used on the acid side, i.e., with an excess of aluminum chloride. Starting a little later, about 1975 it is rumored, workers at the Anglo American Company in South Africa began experi-

menting with positive electrodes consisting of iron or nickel chloride, using an electrolyte system that was similar to that of ESB except that the sodium tetrachloroaluminate was used on the basic side, i.e., with an excess of sodium chloride. The Anglo American work was focused on the high-temperature chlorination of the metal carbides as the means to form the porous iron or nickel chloride positive electrodes. Ultimately, the work at ESB was abandoned, while that at Anglo American blossomed, eventually leading to the formation of Zebra Power Systems S.A. in South Africa. The latter has been involved, since about 1980, in a number of collaborative programs with UKAEA Harwell and Beta R&D Ltd. in the UK to develop the sodium/metal chloride battery technology. The embodiment with iron chloride has become known as the Zebra battery, while the nickel chloride variant is known as the Cheetah battery. 17 refs., 4 figs., 2 tabs.

56698 **(SAND—88-0594C) Performance modeling of lead-acid batteries in photovoltaic applications.** Chamberlin, J.L. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 7p. (CONF-880965—6). NTIS, PC A02. Order Number DE89000502/JAW.

From 20. IEEE photovoltaic specialists conference; Las Vegas, NV, USA (26 Sep 1988).

The modeling of photovoltaic (PV) systems requires accurate descriptions of the performance of the system's individual subsystems and their interrelationships. For stand-alone application simulations, this requires an effective model of the energy storage subsystem, which generally consists of lead-acid batteries and their associated charge controller. A test of five lead-acid batteries of four generic types was conducted to determine the effectiveness of the energy storage subsystem's model used in Sandia's PV systems' simulation code PVFORM. While PVFORM accurately represented an adequately charged battery operating in a system with little excess array energy, considerable care was required in establishing the model's user-defined input parameters to describe the more typical performance of a battery when used with a controller that does not maximize the array's utilization. Causes for this poorer-than-expected battery performance are presented along with their impact on both system design and performance modeling. 6 refs., 8 figs., 2 tabs.

56699 **(SAND—88-2154) Exploratory battery technology development and testing report for 1987.** Magnani, N.J.; Diegle, R.B.; Braithwaite, J.W.; Bush, D.M.; Butler, P.C.; Freese, J.M.; Grothaus, K.R.; Murphy, K.D.; Scott, D.W. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1988. Contract AC04-76DP00789. 180p. NTIS, PC A09/MF A01. Order Number DE89001277/JAW.

Sandia National Laboratories, Albuquerque, has been designated as Lead Center for the Exploratory Battery Technology Department and Testing Project, which is sponsored by the US Department of Energy's Office of Energy Storage and Distribution. In this capacity, Sandia is responsible for the engineering development of advanced rechargeable batteries for both mobile and stationary energy storage applications. This report details the technical achievements realized in pursuit of the Lead Center's goals during calendar year 1987. 47 refs., 73 figs., 48 tabs.

29 ENERGY PLANNING AND POLICY

56700 **(AFME—84-0097-17) Energetic cooperation with developing countries: policies analysis.** (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). 1985. 38p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754974/JAW.

A precise analysis of the oil crisis and their consequences on the developing countries economies is first presented. It is shown that the relation between the oil crisis impact and the economic growth of these countries is not very important. The financial stresses are more determinant on the developing countries situation. Priority will be given to the basis infrastructure which have to be developed for energy production. The various cooperation policies with developed countries are reviewed and assessed.

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 56524, 56764

56701 **(DOE/EIA—0293(88)) Directory of Energy Information Administration model abstracts 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Statistical Standards). [1988]. 91p. NTIS, PC A05/MF A01 - GPO. Order Number DE89001069/JAW.

This directory contains descriptions about each basic and auxiliary model, including the title, acronym, purpose, and type, followed by more detailed information on characteristics, uses, and requirements. For developing models, limited information is provided. Sources for additional information are identified. Included in this directory are 44 EIA models active as of February 1, 1988; 16 of which operate on personal computers. Models that run on personal computers are identified by "PC" as part of the acronyms. The main body of this directory is an alphabetical listing of all basic and auxiliary EIA models. Appendix A identifies major EIA modeling systems and the models within these systems, and Appendix B identifies EIA models by type (basic or auxiliary). Appendix C lists developing models and contact persons for those models. A basic model is one designated by the EIA Administrator as being sufficiently important to require sustained support and public scrutiny. An auxiliary model is one designated by the EIA Administrator as being used only occasionally in analyses, and therefore requires minimal levels of documentation. A developing model is one designated by the EIA Administrator as being under development and yet of sufficient interest to require a basic level of documentation at a future date. EIA also leases models developed by proprietary software vendors. Documentation for these "proprietary" models is the responsibility of the companies from which they are leased. EIA has recently leased models from Chase Econometrics, Inc., Data Resources, Inc. (DRI), the Oak Ridge National Laboratory (ORNL), and Wharton Econometric Forecasting Associates (WEFA). Leased models are not abstracted here.

56702 **(DOE/EIA—00293(88)) Directory of Energy Information Administration Models, 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Statistical Standards). 29 Sep 1988. 87p. NTIS, PC A05/MF A01 - GPO. Order Number DE89000462/JAW.

The directory revises and updates the Directory of Energy Information Administration Model Abstracts, DOE/EIA-0292(87), Energy Information Administration (EIA), US Department of Energy, August 1987. The major changes are the inclusion of additional basic and auxiliary models, including personal computer models used for producing the Annual Energy Outlook, 1987, and the creation of an appendix to show developing models. This directory contains descriptions about each basic and auxiliary model, including the title, acronym, purpose, and type, followed by more detailed information on characteristics, uses, and requirements. For developing models, limited information is provided. Sources for additional information are identified. Included in this directory are 44 EIA models active as of February 1, 1988; 16 of which operate on personal computers. Models that run on personal computers are identified by PC as part of the acronyms. The main body of this directory is an alphabetical listings of all basic and auxiliary EIA models. Appendix A identifies major EIA modeling systems and the models within these systems, and Appendix B identifies EIA models by type (basic or auxiliary). Appendix C lists developing models and contact persons for those models.

56703 **(GERAD—8507) MARKAL-QUEBEC dictionary and data base.** Haurie, A. (GERAD Ecole des Hautes Etudes Commerciales, Montreal, Quebec (Canada)). Jul 1985. 352p. (CE—01941). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This two-part volume contains the data base of the MARKAL-QUEBEC energy modeling program. The first part, which constitutes the MARKAL dictionary, contains the list of all classes and their members. The second part contains the complete data set, presented as input tables to meet the requirements of the

model. The tables are regrouped in sections in accordance with the class definition: in this way, one can find successively the tables SRC, CON, PRC, DMD, and ADRATIO (one table TCH is associated with each of the first four classes). At the beginning of each section, a brief description of the input data is given.

56704 **(GERAD—G-85-27) A model of industrial energy use and conversion for Quebec.** Normadin, M. (GERAD Ecole des Hautes Etudes Commerciales, Montreal, Quebec (Canada)). Dec 1985. 60p. (CE—01933). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The aim of this report is to present recent developments in the modelling of the industrial sector energy uses incorporated in MARKAL-QEUBEC, a comprehensive description of the Quebec energy system in the form of a linear activity analysis model. MARKAL is a techno-economic model since its data base is mainly composed of technical coefficients describing inputs and outputs of a very large set of technologies, including their efficiencies, their costs (investment and operation, fixed and variable), their lifetime, their dates of availability, and residual capacity. The model presents an overview of what changes might occur within an industry (such as penetration rates of new processes, impacts on energy consumption) in response to changes outside the industry (such as end-product demand, fuel prices, new alternative technologies). It gives a description of the age structure of all capital equipment which therefore allows the model to capture possible implementation dates of new technologies. And, it provides the first elements of a techno-economic data base for the industrial sector which can be basis of further developments. 21 refs., 11 figs.

56705 **(GERAD—G-85-28) Technology evaluation with MARKAL.** Haurie, A.; Loulou, R. (GERAD Ecole des Hautes Etudes Commerciales, Montreal, Quebec (Canada)). Dec 1985. 19p. (CE—01944). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report deals with the assessment of energy technologies using the MARKAL model. Several methods of evaluating the relative merits of technologies are reviewed, and a comprehensive approach is recommended which is based on two complementary aspects of the MARKAL outputs: the primal results, which describe penetration values of technologies, and the dual results, which indicate marginal system values of technologies. The approach has the advantage of being totally coherent with the linear programming framework of MARKAL. A linear programming model is a paradigm of a production system with a strong economic consistency. The search for optimality is a prerequisite to any technology assessment, as it provides a basis for a comparison under the assumption of an efficient use of each technology. The marginal system value gives an evaluation of how close to optimality is an activity not included in the primal solution; it also indicates the importance of the contribution to the optimum of an activity which appears in the primal solution. A technology ranking procedure which would use this marginal value analysis would thus be based on a sound theoretical, and economic approach, free of any a priori assumption, except those which have served in the building of the MARKAL data base. This information should be of considerable value for technology assessment. The approach is illustrated with the output of a typical MARKAL-QUEBEC run. 3 refs., 3 tabs.

56706 **(RISO-M—2706) Project planning and analysis. Metods for assessment of rural energy projects in developing countries.** Christensen, J.M. (Risoe National Lab., Roskilde (Denmark)). Apr 1988. 160p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88754882/JAW.

The report presents the results of both a theoretical and an empirical study of the role of project analysis in the national planning efforts of developing countries. The most commonly used methods for especially the economic analysis - the socalled "cost-benefit methods" - are described in detail and the historical development of these methods is related to the dominant development theories. The theoretical and ideological basis, the methodological principles and the practical use of the methods are critically discussed. The empirical study is based on a close collaboration with the Department of Energy (DOE) in Zambia, and focus has been on the activities aiming at energy and development in rural and suburban areas. Based on an evaluation of the specific planning situation in the DOE a new approach to project analysis aiming at the activities related to energy and rural development has been developed. The approach has been implemented on a personal computer and a user oriented presentation of the simple and modular model (PRAM) is included. The new approach reflects the criticism of the existing methods and emphasizes the importance of a combination of qualitative and quantitative considerations in the analysis and the use of a broad set of criteria. 27 ills., 74 refs.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 56451, 56705, 56706, 56733, 56741, 56747, 56752, 56763, 56765, 56767, 56770, 56775, 56776, 56777, 56778, 56779, 56781, 56782, 56783, 56785, 56787, 56801, 56892, 58280

56707 **(ORNL—6436) The impacts of inadequate electricity supply in developing countries.** Jones, D.W.; Sanghvi, A.P.; Hillsman, E.L. (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 61p. NTIS, PC A04/MF A01. Order Number DE89001346/JAW.

Many developing countries are experiencing growth in demand for electricity that exceeds their ability to increase generation capacity. Unreliable electricity supplies and unserved demands are consequences. Costs of low quality electricity supply, or unreliable supplies, in manufacturing sectors alone, have been estimated to be as high of 1.8% of gross national product in Pakistan and India in the early 1980s. Losses in the commercial sector, agriculture, and consumer surplus losses in households would raise the loss estimates. Continued expansion of generation capacity is unlikely to be a viable option. Expansion costs during the 1985-1994 period have been estimated at $520 billion in 1985 prices. This amount does not appear to be available in world capital markets, and rearrangement of national development expenditures to accommodate further power sector spending is constrained by the fact that the power sector typically claims 25% to 40% of government capital expenditures already. 51 refs., 13 tabs.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 56012, 56041, 56165, 56198, 56298, 56341, 56405, 56408, 56424, 56605, 56640, 56707, 56730, 56787, 57456, 57457, 57525, 57545, 57546, 57547, 57548, 57550, 57551, 57553

56708 (ASPB—8404, pp 141-156) **Environmental planning and mitigation in Kananaskis country.** Mill, T. (Alberta Energy and Natural Resources, Edmonton). [1988]. Alberta Society of Professional Biologists, P.O. Box 566, Edmonton, Alta., Canada T5J 2K8; $15.00 CAN; MFCANMET/TID; Energy, Mines and Resources, CAN, 555 Booth St., Ottawa Ont., CAN K1A 0G1; $10 CAN. (CONF-8404344—; MICROLOG—88-00214).

From Symposium on environmental mitigation: solutions to problems; Edmonton, Canada (24 Apr 1984).

This paper reviews the policy and planning framework under which land use development in Alberta's Kananaskis Country proceeded, and the process by which environmental planning and mitigation decisions were reached. Case studies are presented to show how these issues were addressed in practice. Most of the projects involved recreational facility development, and land use zoning was used to separate and constrain developments throughout the region. Certain areas were selected for relatively intense development to provide focal points for activity staging, and a key contributing factor in the zoning process was the location of important wildlife resources. Energy resource developments are also included in the region, constrained by the recreation facility developments; appropriate design enabled a sour gas production and pipeline to be installed. To address impacts inherited from prior development projects, a landscape rehabilitation program was included. 11 refs.

56709 (ASPB—8404, pp 119-136) **The government framework for environmental mitigation in Alberta: the role of Alberta environment.** Smith, K.R. (Alberta Environment, Edmonton). [1988]. Alberta Society of Professional Biologists, P.O. Box 566, Edmonton, Alta., Canada T5J 2K8; $15.00 CAN; MFCANMET/TID,Energy, Mines and Resources, CAN, 555 Booth St., Ottawa, Ont., CAN K1A 0G1; $10 CAN. (CONF-8404344—; MICROLOG—88-00214).

From Symposium on environmental mitigation: solutions to problems; Edmonton, Canada (24 Apr 1984).

Alberta Environment's responsibilities are to achieve a balance between resource management, environmental protection, and quality of life. One responsibility includes establishing and monitoring environmental standards for air and water quality; data are reviewed to show that compliance with these standards is over 96%. The agency also plays a major role in site decisions associated with major new resource development proposals, usually in the preliminary disclosure stage. It participates in land use planning and in the environmental impact assessment process. The regulatory process is another important part of the agency's responsibilities; two aspects of this process include avoiding and preventing environmental impacts which are not mitigable, and managing any mitigable impacts. A high degree of compliance with environmental standards is achieved by a system that involves negotiation of compliance.

56710 (ASPB—8404, pp 103-118) **The government framework for environmental mitigation in Alberta: the role of the Energy Resources Conservation Board.** Brushett, E.R.; Weleschuk, I.T. (Energy Resources Conservation Board, Calgary, Alta.). [1988]. Alberta Society of Professional Biologists, P.O. Box 566, Edmonton, Alta., Canada T5J 2K8; $15.00 CAN; MFCANMET/TID,Energy, Mines and Resources, CAN, 555 Booth St., Ottawa, Ont., CAN K1A 0G1; $10 CAN. (CONF-8404344—; MICROLOG—88-00214).

From Symposium on environmental mitigation: solutions to problems; Edmonton, Canada (24 Apr 1984).

The Alberta Energy Resources Conservation Board is responsible for administering the exploration for, processing of, and transportation of energy in Alberta. Its role in environmental aspects of energy development includes responsibility for ensuring that operation of oil and gas facilities meets environmental standards. A significant part of the approval process for new energy projects is handled by the Board. A key part of this process is the public hearing, which considers the technical aspects of the proposal along with the environmental aspects. Another activity of the Board is the inquiry, for the purpose of reviewing a current policy or industry practice, or for reviewing a specific incident to develop recommendations for future protective measures. Regulation during the operational phase of an energy project is intended to ensure that the project has been built according to the approved project proposal, and is operating in accordance with all license conditions, guidelines, and regulations. Inspections are carried out regularly to ensure technical competence in operation and to identify and remedy possible environmental problems.

56711 (ASPB—8404, pp 83-102) **The legal basis for environmental mitigation in Alberta.** Hunt, C.D. (Univ. of Calgary, Alta.). [1988]. Alberta Society of Professional Biologists, P.O. Box 566, Edmonton, Alta., Canada T5J 2K8; $15.00 CAN; MFCANMET/TID,Energy, Mines and Resources, CAN, 555 Booth St., Ottawa, Ont., CAN K1A 0G1; $10 CAN. (CONF-8404344—; MICROLOG—88-00214).

From Symposium on environmental mitigation: solutions to problems; Edmonton, Canada (24 Apr 1984).

This paper examines the role of the Canadian legal system in environmental mitigation from four aspects: the extent to which the common law, as applied by civil courts, can be utilized to achieve mitigation; the role of the prosecutorial system, where criminal proceedings are launched for breach of environmental standards; the role of the regulatory system in Alberta in relation to environmental mitigation; and the adoption of negotiated mitigation and compensation measures by developers in relation to those affected by a particular project. Common law remedies are available in the areas of private and public nuisance, and riparian rights, although civil courts have disadvantages as agencies for environmental mitigation including delays and high costs. A number of difficulties are also involved in using the criminal courts in mitigation processes, including difficulty of reaching a standard of proof in cases of scientific complexity, delays, and costs of trials. In view of the aforementioned disadvantages, the role of the regulatory system is felt to be more important. However, use of the regulatory system also has its disadvantages, including cost, complexity, and delays in the hearing process. Attention is turning to new methods of resolving contentious issues outside of the regulatory process, and examples are given from Canadian experience. These include an agreement between an Indian band and developers of a liquefied natural gas project, and between a power project and landowners. Such agreements enable the affected parties to deal with each other directly, provide requirements for mitigation measures in advance, and establish dispute settlement procedures. 30 refs.

56712 (ASPB—8404, pp 25-35) **Native respectives related to mitigation in resource development.** Piche, M. (Cold Lake Band, Grand Centre, Alberta). [1988]. Alberta Society of Professional Biologists, P.O. Box 566, Edmonton, Alta., Canada T5J 2K8; $15.00 CAN; MFCANMET/TID, Energy, Mines and Resources, CAN, 555 Booth St., Ottawa, Ont., CAN K1A 0G1 $10 CAN. (CONF-8404344—; MICROLOG—88-00214).

From Symposium on environmental mitigation: solutions to problems; Edmonton, Canada (24 Apr 1984).

This paper presents an Alberta Indian's perspective on environmental and social effects of energy source development, notably from the Cold Lake oil sands project. These include impacts on the lake itself and on traditional hunting areas. Dealings with relevant government agencies are also mentioned.

56713 (ASPB—8404, pp 17-24) **Political aspects of mitigation: a landowner's perspective.** Cooper, M. (Cowley, Alberta). [1988]. Alberta Society of Professional Biologists, P.O. Box 566, Edmonton, Alta., Canada T5J 2K8; $15.00 CAN; MFCANMET/TID,Energy, Mines and Resources, CAN, 555 Booth St., Ottawa, Ont., CAN K1A 0G1; $10 CAN. (CONF-8404344—; MICROLOG—88-00214).

From Symposium on environmental mitigation: solutions to problems; Edmonton, Canada (24 Apr 1984).

This paper presents the views of an Alberta farmer on the environmental impact assessment and mitigation process with respect to energy projects. The role of certain government agencies and of the various hearing, assessment, and informational processes is assessed. Alberta Environment's priorities are examined and it is concluded that this agency devotes most of its time and budget to water resources management rather than pollution control and prevention, The environmental hearing process as conducted by the Environmental Council of Alberta (ECA), Energy Resources Conservation Board, and the Alberta Water Commission are reviewed, and the problems with these agencies include lack of political will to implement ECA recommendations, lack of effective non-resource-industry representation at hearings, and biases toward dam building. The current environmental impact assessment process in Alberta is criticized for its arbitrariness, delay, and lack of follow-up. Access to environmental information is felt to be an important part of the assessment/mitigation process but is seen as not being sufficient. Finally, ownership rights and resource management are examined, with the recognition that unless resources are dealt with as important in their own right rather than just for economic value, mitigation of environmental impacts is difficult to implement. Recommendations are made for government policies and for restructuring the hearing process.

56714 (ASPB—8404, pp 5-16) **A personal view of environmental impacts and their mitigation.** Millard, V. (Energy Resources Conservation Board, Calgary, Alta.). [1988]. Alberta Society of Professional Biologists, P.O. Box 566, Edmonton, Alta., Canada T5J 2K8; $15.00 CAN; MFCANMET/TID,Energy, Mines and Resources, CAN, 555 Booth St., Ottawa, Ont., CAN K1A 0G1; $10 CAN. (CONF-8404344—; MICROLOG—88-00214).

From Symposium on environmental mitigation: solutions to problems; Edmonton, Canada (24 Apr 1984).

This paper provides a view of the application, review, and hearing system for energy resource projects from the perspective of how this process deals with the problems of environmental impacts and their mitigation. The kinds of impacts likely from Alberta industries are considered to be direct, i.e. largely on-site impacts due to a specific development such as drilling a well; and indirect, i.e. generally offsite and related to possible environmental effects of a specific project. Problems arise not only in dealing with these impacts but also with how the impacts are perceived. Certain questions keep arising at hearings and the review process does not provide a means for answering them. It is felt that these questions arise because of a possible lack of realistic assessments of actual environmental effects, a wide range of scientific opinions on the nature of such effects, and a possible lack of base line data. In some instances, more information is required, and this information may be obtainable by investigation; many recurring concerns about impacts are not assessed, even though they could be assessed by drawing on previous experience; discrepancies between scientific opinions could be resolved by a more complete review of the position of each of the parties involved in the hearing; wide differences between public perception and scientific evidence is not resolved, and could be taken into account by proper use of community committees and public information; and, research activities are frequently carried out without public knowledge or participation. Recommendations are made to resolve such differences.

56715 **(ASPB—8404) Environmental mitigation: solutions to problems.** (Alberta Society of Professional Biologists, Edmonton (Canada); Energy Resources Conservation Board, Calgary, Alberta (Canada); Environment Council of Alberta, Edmonton (Canada)). [1988]. 221p. (CONF-8404344—; MICROLOG—88-00214). Alberta Society of Professional Biologists, P.O. Box 566, Edmonton, Alta., Canada T5J 2K8; $15.00 CAN; MFCANMET/TID, Energy, Mines and Resources CAN, 555 Booth St., Ottawa, Ont., CAN K1A 0G1; $10 CAN.

From Symposium on environmental mitigation: solutions to problems; Edmonton, Canada (24 Apr 1984).

A conference was held involving biologists and other interested parties from governments and the private sector to examine developments in the mitigation of environmental effects of energy projects. Specific topics covered included political aspects of mitigation, mitigation planning at sour gas, hydroelectric, and coal mining facilities, legal aspects of mitigation, the role of governments, and recreational facilities. Separate abstracts have been prepared for nine papers from this conference.

56716 **(CEARC—EN106-7/1987E) Cumulative effects assessment in Canada: an agenda for action and research.** Peterson, E.B.; Chan, Y.-H.; Peterson, N.M.; Constable, G.A.; Caton, R.B.; Davis, C.S.; Wallace, R.R.; Yarranton, G.A. (Canadian Environmental Assessment Research Council, Hull, Quebec). 1987. 68p. (MICROLOG—88-00494). Federal Environmental Assessment Review Office, Fontaine Bldg., 13th floor, Ottawa, Ont., Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This review of cumulative environmental effects assessment in Canada identified 13 sets of issues that are considered to be of particular significance to Canadians over the next decade or two. They are: long-range transport of air pollutants; urban air quality and airshed saturation, mobilization of persistent or bioaccumulated substances, climatic modification, land occupation by man-made features, habitat alienation and fragmentation, soil losses, effects of agricultural chemicals, groundwater supply reduction and contamination, increased sediment, chemical and thermal loading of freshwater and marine habitats, accelerating rates of renewable resource harvesting, and long-term containment and disposal of toxic wastes. There is a diverse set of examples in which cumulative effects have been recognized and brought under control and management, and the scientific and institutional factors that promoted a successful approach are summarized. It was confirmed that there are well-defined limitations in the degree to which project referrals and project-specific environmental impact assessments can be adapted to manage cumulative effects successfully. In general, this review confirmed the hypothesis that current approaches for both scientific analyses and institutional arrangements to manage cumulative effects remain inadequately developed in Canada. To address this weakness, action is required on improving links between ecosystems, research, and management. Recommendations are made and a research agenda is presented. 171 refs., 5 figs., 2 tabs.

56717 **(CONF-880839—6) Resolving issues at the Department of Energy/Oak Ridge Operations Facilities.** Row, T.H.; Adams, W.D. (Oak Ridge National Lab., TN (USA); USDOE Oak Ridge Operations Office, TN). 1988. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01. Order Number DE88017366/JAW.

From Annual DOE low-level waste management conference; Denver, CO, USA (30 Aug 1988).

Waste management, like many other issues, has experienced major milestones. In 1971, the Calvert Cliff's decision resulted in an entirely different approach to the consideration of environmental impact analysis in reactor siting. The accidents at Three Mile Island and Chernobyl have had profound effects on nuclear power plant design. The high-level waste repository program has had many similar experiences that have modified the course of events. The management of radioactive, hazardous chemical and mixed waste in all of the facilities of the Oak Ridge Operations (ORO) Office of the Department of Energy (DOE) took on an entirely different meaning in 1984. On April 13, 1984, Federal Judge Robert Taylor said that DOE should proceed 'with all deliberate speed' to bring the Y-12 plant into compliance with the Resource Conservation and Recovery Act and the Clean Water Act. This decision resulted from a suit brought by the Legal Environmental Assistance Foundation (LEAF) and grew out of a continuing revelation of mercury spills and other problems related to the Oak Ridge plants of DOE. In this same time frame, other events occurred in Oak Ridge that would set the stage for major changes, to provide the supporting environment that allowed a very different and successful approach to resolving waste management issues at the DOE/ORO Facilities. This is the origin of the Oak Ridge Model which was recently adopted as the DOE Model. The concept is to assure that all stakeholders in waste management decisions have the opportunity to be participants from the first step. A discussion of many of the elements that have contributed to the success of the Model follows.

56718 **(CONF-881054—14) The installation restoration program: Three years of experience in the Department of Defense CERCLA program.** Franco, P.J.; Porell, A.L. (Martin Marietta Energy Systems, Inc., Oak Ridge, TN (USA)). 1988. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01. Order Number DE89001206/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

The Hazardous Waste Remedial Actions Program (HAZWRAP) Support Contractor Office plays a major role in the Department of Defense (DOD) Installation Restoration Program (IRP). The IRP is DOD's program for identifying past disposal sites and for eliminating hazards to public health and the environment. Since 1986, HAZWRAP has conducted a variety of projects for the US Air Force and Navy at the request of the Department of Energy (DOE). This paper discusses HAZWRAP's involvement in the IRP, some of the lessons learned during the course of this relationship, and initiatives that are being taken to remove sites from the IRP. The DOE may have an interest in HAZWRAP's experiences with the IRP in planning for its equivalent program. 3 tabs.

56719 **(CONF-881077—5) Department of Energy hazardous waste remedial actions program: Quality assurance program.** Horne, T.E. (Martin Marietta Energy Systems, Inc., Oak Ridge, TN (USA)). [1988]. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01. Order Number DE88015289/JAW.

From 15. annual national Energy Division conference; San Antonio, TX, USA (23 Oct 1988).

This paper describes the Quality Assurance Program developed for the Hazardous Waste Remedial Actions Program Support Contractor Office (HAZWRAP SCO). Key topics discussed include an overview of the HAZWRAP SCO mission and organization, the basic quality assurance program requirements and the requirements for the control of quality for the Department of Energy

and Work for Others hazardous waste management programs, and the role of ensuring quality through the project team concept for the management of remedial response actions. The paper focuses on planning for quality assurance for this remedial waste management process from preliminary assessments of remedial sites to feasibility studies. Some observations concerning the control of quality during the implementation of remedial actions are presented. (2 refs.)

56720 **(EPRI-EA—6030) Benefits of environmental controls: Measures, methods, and applications: Final report.** Peterson, D.C. Jr.; Violette, D.M.; Rowe, R.D.; Chestnut, L.G.; Hakkarinen, C. (ed.). (Electric Power Research Inst., Palo Alto, CA (USA); Energy and Resource Consultants, Inc., Boulder, CO (USA)). Oct 1988. 115p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89000571/JAW.

This report, written for senior environmental managers in electric utilities, reviews the economic measures, methods and applications of damage estimation techniques from environmental pollution in the United States. Proposed regulations to mitigate detrimental effects of environmental pollutants may require detailed calculations of the expected costs of control expected benefits to society, in order to identify economically efficient means for environmental improvement. This report describes, in a simplified manner, the measures of value that are applied by economists to quantify damages and benefits to natural resources. It also summarizes and assesses different economic approaches for acquiring benefits information for natural resources (known in the economics parlance as "non-market public goods"). Items covered for each approach include: conceptual background, major strengths, major weaknesses, and key assumptions. The final section of the report reviews recent and particularly significantly economic studies of air pollution impacts on agriculture, materials, visibility, aquatic systems, and human health. These reviews highlight the economic methods used, the types of input data required, and prominent strength and weaknesses in the published results. 153 refs., 6 figs., 6 tabs.

56721 **(ORNL—6450/R8) Environmental Sciences Division: Environmental regulatory update table.** Langston, M.E.; Nikbakht, A.; Salk, M.S. (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 131p. NTIS, PC A07/MF A01. Order Number DE89001349/JAW.

The Environmental Regulatory Update Table provides information on regulatory initiatives of interest to DOE operations and contractor staff with environmental management responsibilities. The table is updated each month with information from the Federal Register and other sources, including direct contact with regulatory agencies. Each table entry provides a chronological record of the rulemaking process for that initiative with an abstract and a projection of further action.

56722 **(ORNL/TM—10789) Hazardous waste minimization practices in Tennessee.** Barkenbus, B.D. (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 140p. NTIS, PC A07/MF A01. Order Number DE89001139/JAW.

The minimization of hazardous waste generation as well as the proper treatment and disposal of generated waste has great importance for the protection of present and future human health and the environment. The purpose of this study was to identify the extent of waste minimization practices carried out by Tennessee waste generators since September 1985 and to determine the importance of waste minimization factors as perceived by Tennessee waste generators. This was accomplished methodologically through survey research of large Tennessee waste generators. During the period between August 12, 1987, and October 7, 1987, two mailings and telephone reminders produced a 68.4% response rate from 266 waste generators. The population was categorized in three stratified groupings, based on the quantity of hazardous waste produced: Group One, produced more than 1 million kg per year; Group Two, produced between 100,000 and 1 million kg per year; and Group Three, produced less than 100,000 kg per year but more than 1000 kg per year. 127 refs., 8 figs., 20 tabs.

56723 **(PB—88-233424/XAB) Hazardous waste management in the Pacific northwest. Final report: findings and recommendations.** (Environmental Protection Agency, Seattle, WA (USA)). Mar 1988. 90p. (EPA—910/9-88/187). NTIS, PC A05/MF A01.

EPA and the four Pacific Northwest States of Alaska, Idaho, Oregon and Washington joined together to assess current and future issues and to explore the opportunities associated with hazardous waste in the Pacific Northwest, the report explores data/capacity assessment, waste reduction and siting of new facilities. Recommendations include establishing a Pacific Northwest Hazardous Waste Advisory Council, developing a waste reduction strategy, performing additional analysis of regional wastestream and improving Northwest data collection systems.

56724 **(PB—88-235569/XAB) Toxic substances annual list, 1971.** Christensen, H.E. (National Inst. for Occupational Safety and Health, Rockville, MD (USA)). 1971. 527p. (DHEW/PUB/HSM—72/10260). NTIS, PC A23/MF A01.

Also available from Supt. of Docs. See also PB—88-235593.

The list fulfills the requirements of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, Public Law 91-596, which requires that the Secretary of Health, Education, and Welfare shall publish within six months of enactment of this Act and thereafter as needed, but at least annually, a list of all known toxic substances by generic family or other useful grouping, and the concentrations at which such toxicity is known to occur. The List format consists of three sections, the chemical name of the toxic substance in capital letters, arranged alphabetically, its toxic dose and effects for man and/or mammal, and the literature references. Because of the severe time restrictions imposed by the Act, the first issue of the List is incomplete.

56725 **(PB—88-235577/XAB) Toxic substances list, 1972 edition.** Christensen, H.E. (Tracor JITCO, Inc., Rockville, MD (USA)). Jun 1972. 598p. (DHEW/PUB/HSM—72/10265). NTIS, PC A25/MF A01.

See also PB—88-235569.

The list of toxic substances is the second edition of the Toxic Substances List which is prepared at least annually in accordance with Section 20(a)(6) of the Occupational Safety and Health Act of 1970, Public Law 91-596. In reviewing the second edition of the List, readers should be aware of the magnitude and complexity of the task. While some 13,000 toxic substance items are listed, there are perhaps double that number which have not yet been included. The absence of a substance does not, therefore, necessarily indicate that a substance is not toxic. Some hazardous substances may not qualify for the List because the dose that causes toxic effect is not known, and, therefore, the substance cannot be included. Other chemicals associated with skin sensitization and carcinogenicity may be omitted from the List because these effects have not been reproduced in experimental animals or because the human data is not definitive.

56726 **(PB—88-235585/XAB) Toxic substances list, 1973 edition.** Christensen, H.E. (Tracor JITCO, Inc., Rockville, MD (USA)). Jun 1973. 1047p. (DHEW/PUB/HSM—099-72-0042). NTIS, PC A99.

Also available from Supt. of Docs. See also PB—88-235577; Portions of this document are not fully legible.

The 1973 edition of the Toxic Substances List is the second revision of the list of toxic substances prepared at least annually in accordance with Section 20(a)(6) of the Occupational Safety and Health Act of 1970, Public Law 91-596. The list includes the original list published in June 1971 and the second edition published in June 1972. The list contains 25,043 entries; approximately 11,000 main entries are accompanied by a description of the substance, information on its toxicity and references to existing USA standards and criteria documents, the remaining 14,000 entries being synonyms and cross references. Specific data are provided on the toxicity of each substance related to: route of administration, animal species involved, type of exposure reported (e.g. lethal), dose which caused toxic response, and body system affected. The bibliographical sources from which the toxicity data were extracted are all listed. Absence of a substance does not imply that it is innocuous.

56727 **(PB—88-239223/XAB) Test methods for evaluating solid waste. Volume 1A through 1C, and Volume 2. Field manual physical/chemical methods (3rd edition).** (Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste and Emergency Response). Sep 1986. 1748p. (EPA/SW—846). NTIS, PC A99/MF E14.

Also available from Supt. of Docs, See also Second Edition, PB—87-120291.

This manual provides test procedures that may be used to evaluate those properties of a solid waste that determine whether the waste is a hazardous waste within the definition of Section 3001 of the Resource Conservation and Recovery Act (PL 94-580). These methods are approved for obtaining data to satisfy the requirement of 40 CFR Part 261, Identification and Listing of Hazardous Waste. Volume IA deals with quality control, selection of appropriate test methods, and analytical methods for metallic species. Volume IB consists of methods for organic analytes. Volume IC includes a variety of test methods for miscellaneous analytes and properties for use in evaluating the waste characteristics. Volume II deals with sample acquisition and includes quality control, sampling-plan design and implementation, and field-sampling methods.

56728 **(PB—88-242524/XAB) Procurement under Superfund remedial cooperative agreements.** (Booz, Allen and Hamilton, Inc., Bethesda, MD (USA)). Jun 1988. 141p. NTIS, PC A07/MF A01.

See also PB—84-208784.

This document provides guidance on procuring services during remedial-response activities under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), or Superfund, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). The topics covered in the guidance include procurement requirements; procurement of engineering services, including types of services provided; procurement of construction contractors; and subagreement administration.

56729 **America's water quality - regional perspective: Tennessee Valley.** Duda, A.M.; Campbell, A.J. *Forum for Applied Research and Public Policy (Knoxville,Tennessee);* **2**: No. 4, 59-66(Win 1987).

The Tennessee Valley region consists of 201 counties served by the Tennessee Valley Authority (TVA) power distribution network. It covers all of Tennessee and parts of Alabama, Georgia, Kentucky, Mississippi, North Carolina, and Virginia. The area is typical of the mid-South, ranging from Appalachia's steep, forested mountains on the east to flat flood plains bordering the Mississippi River on the west. The region is primarily rural - only 16 of the 201 counties have more than 75,000 residents. The Tennessee River, the nation's fifth largest, is the dominant surface-water feature. Many of the region's major rivers and reservoirs are safe for recreation and support a diverse fishery. Yet, most experience some water-quality impairment, at least on a seasonal basis, that prevents them from fully achieving clean water goals set by Congress. This regional picture parallels the national situation, with more than 50 percent of the nation's water impacted by pollution and data showing minimal improvements in river water quality except for reductions in fecal bacteria.

2904 Natural Resources

REFER ALSO TO CITATION(S) 56708, 56737, 56854, 57096, 57544

56730 **(EC—EN21-69/1987E) Environment and development; a Canadian perspective.** (Environment Canada, Ottawa, Ontario). [1988]. 28p. (MICROLOG—88-00407). Environment Canada, Publications Section, Terrasses de la Chaudiere, Ottawa, Ont., Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This document outlines the strategies Canada is following to promote sustainable development, i.e. economic and resource development that meets present needs without compromising the meeting of future needs, both at home and abroad. The Canadian setting is introduced by pointing out that although Canada has traditionally been seen as being resource abundant, problems such as degradation of water and soils point to future problems. Mechanisms for sustainable development require implementation as a response, and a number of federal policy initiatives are described. These include institutional strategies involving intergovernmental cooperation, information sharing, and conservation. A corollary of these initiatives is the promotion of international cooperation in managing shared resources; Canadian policies in this regard include the Montreal Protocol on atmospheric ozone depletion, acid rain agreements with the USA, and international agreements on the oceans, genetic diversity, the Great Lakes, and aid to developing countries to promote sustainable development. As for Canada itself, various resource management and conservation policies are given in the fields of agriculture, forestry, fisheries, and energy, the latter including energy conservation incentive programs, oil substitution programs, and developments in alternative energy sources. 7 figs.

56731 **(EMR—8501) Research agreements program in the natural, physical and social sciences and engineering. Progress summary, 1985.** (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada)). Jan 1985. 175p. (CE—01954). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Research programs of Energy, Mines and Resources Canada are listed in this document providing project title, objectives, names of investigators, and an abstract of the progress to date. Projects are presented according to the sponsoring department: Mineral Policy Sector, Canada Centre for Mineral and Energy Technology, Earth Physics Branch, Geological Survey of Canada, Surveys and Mapping Branch, and Energy Policy Sector.

56732 **(LP/RB—80-8E) Offshore mineral resources: legal aspects.** Smith, M. (Canada Library of Parliament, Ottawa, Ontario. Research Branch). May 1987. 39p. (MICROLOG—88-00812). Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, Ont., Canada K1A 0S9; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The rights to exploit offshore mineral resources in Canada have been a matter of contention between the federal and provincial governments. This paper discusses the legal aspects of offshore mineral resources, from the time of Confederation, with special references to cases from British Columbia and Newfoundland. The Supreme Court of Canada has been called upon to decide in these cases whether Canada or the provinces have proprietary or exploration rights in, and jurisdiction over, the seabed resources of the territorial sea and the continental shelf off the Canadian coasts. The Court has decided in favor of the federal government, to which it has attributed jurisdiction over and proprietary rights in the seabed and subsoil as well as the resources of the territorial sea of British Columbia, and jurisdiction over and exploration and exploitation rights in the continental shelf. It is apparent that the Maritime provinces are no longer able to claim rights over the continental shelf off the coast of their respective territories. In the case of Newfoundland, an agreement on the offshore oil and gas resources was negotiated, in which the federal government will manage the development of the resource and the province will have broad powers of taxation of offshore resource development. This paper also includes a chronology of Canadian developments in offshore mineral resources law, and related federal/provincial agreements, since 1945. 19 refs.

56733 **(PB—88-231584/XAB) Changes in domestic demand for primary metals due to economic growth, technology change, and change in composition of final demand. Open File report (Final).** Faucett, J.G.; Chmelynski, H.J. (Faucett (Jack) Associates, Bethesda, MD (USA)). Jul 1987. 100p. (JACKFAU—40-88). NTIS, PC A05/MF A01.

Metals consumption and production in the United States did not keep pace with economic growth from 1963 to 1983. For example, steel consumption per million dollars of real GNP decreased from 98 tons to 50 tons during this period, and nonferrous metals consumption decreased from $6250 per million dollars of GNP in

1963 to $4570 in 1983 (measured in 1975 constant dollars). The study, based on an interindustry analysis, identifies and quantifies the contribution of three sources responsible for change in U.S. metals demand and, in turn, production, between 1963 and 1982: Technological change; economic growth; and the composition of final demand. The results of the analysis show that technology was the most-significant factor causing the production of ferrous metals, and production growth rate of nonferrous metals, to decline during the study period.

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 56093, 56122, 56372, 56428, 56429, 56511, 56519, 56701, 56731, 56750, 56784, 56789, 56794, 56857, 57175, 57602, 57711

56734 (AC/R—I-107) Energy research and development program in agriculture and food. Van Die, P. (Agriculture Canada, Ottawa, Ontario. Research Branch). Aug 1982. 99p. (CE—01906). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report outlines Agriculture Canada's research and development program in the energy-related aspects of the agriculture and food system. Research is intended to help the system take advantage of new opportunities in conservation, fuel substitution, and renewable energy. To establish the needs and direct the program, several general studies have been conducted on energy use in the Canadian agricultural sector, to indicate patterns of use and energy requirements. Conservation techniques are being investigated with an emphasis on the economic viability of the technology; specific areas of work include equipment performance and operation, energy conservation and heat recovery systems for greenhouses and animal buildings, and energy conservation in the food processing industry. A close look is being made not only to use agricultural wastes as energy sources, but also to grow crops specifically for energy use. Specific projects include investigations in the combustion, pyrolysis and gasification of residues, and the production of alcohols and vegetable oils for fuel. Other renewable energy sources being investigated are wind and solar energy. A list of energy research contracts is included. 7 figs., 1 tab.

56735 (AD-B—058533/1/XAB) International technological status and export control of composite-materials technology. Volume II. Appendices. Final report. Channon, S.L. (Institute for Defense Analyses, Arlington, VA (USA). Science and Technology Div.). Feb 1981. 135p. (IDA-P—1484-VOL-2). NTIS, PC A07/MF A01.

See also Volume 3, AD-C025 426L; Distribution limitation now removed.

The evolution of composite materials in advanced structural and ablative applications during the past 25 years has been gaining momentum at an accelerated pace. Recent advances in the technology of several composite materials prompted the Department of Defense to request that the Institute for Defense Analyses undertake a study of the international state of the art in composite-materials and the export control of composite materials technology. This report presents the results of an 18-month study of U.S. and foreign technology in organic matrix, metal-matrix, carbon-carbon, and ceramic-matrix composite materials and a critical review of the U.S. export control regulations. The report consists of three volumes, as follows: Volume I - Main body of report (Unclassified, proprietary information). Volume II - Appendices (Unclassified) Volume III - Foreign Technology (Secret, intelligence sources & methods involved). Emphasis was placed on the identification of critical technology items in which the U.S. has a decided lead and which might be used by an adversary to the detriment of the national security of the United States. Information was provided by more than 80 industry and Government organizations abroad in Europe and Japan. An overall comparison of the technological status in the major industrial countries of the world has been made. For the most part, the technology has been advanced further on a broad front in the U.S., with some significant contributions to the technology from foreign sources.

56736 (DOE/ER—0388) Energy Materials Coordinating Committee (EMaCC): Annual technical report, Fiscal year 1987. (USDOE Office of Energy Research, Washington, DC. Office of Basic Energy Sciences). Sep 1988. 474p. NTIS, PC A20/MF A01. Order Number TI89000576/JAW.

The DOE Energy Materials Coordinating Committee (EMaCC) serves primarily to enhance coordination among the Department's materials programs and to further the effective use of materials expertise within the Department. These functions are accomplished through the exchange of budgetary and planning information among program managers and through technical meetings/workshops on selected topics involving both DOE and major contractors. This annual technical report is mandated by the EMaCC terms of reference. This report summarizes EMaCC activities for FY 1987 and describes the materials research programs of various offices and divisions within the Department.

56737 (LA-UR—88-2801) Putting space resources to work. Jones, E.M. (Los Alamos National Lab., NM (USA)). [1988]. Contract W-7405-ENG-36. 11p. (CONF-8810156—1). NTIS, PC A03/MF A01. Order Number DE88016156/JAW.

From International Astronautical Federation symposium on economics of space operations; Bangalore, India (1 Oct 1988).

Resource development in remote places on Earth has depended on government attitudes toward regional development, transport and local production costs, economic accessibility of external markets, and the availability of local markets. The initial stages of space resource development may well depend on a government-funded lunar science/engineering base for initial markets. 10 refs.

56738 (STF—15A87054) Plan of action for combustion engineering research within energy technology. Byggstoeyl, S.; Magnussen, B.; Soenju, O.K.; Oesterboe, E.; Hustad, J.E. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Nov 1987. 51p. (In Norwegian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754896/JAW.

The report presents the plan of combustion engineering research within the field of energy technology in Norway. The plan covers the following aspects: Combustion of coal and biomass fuels; combustion of wastes; fuel characterization; environmental studies; applied reserch; development studies; experimental and measuring practice. The schedule of the projects is ten years, and the total costs for the first period of five years are calculated to be NOK 87.4 million. 5 tables.

56739 (UCRL—21123) Polymeric ultrathin films for applications in opto-electronics: A white paper. Kowel, S.T. (California Univ., Davis (USA). Dept. of Electrical and Computer Engineering). Sep 1987. Contract W-7405-ENG-48. 5p. NTIS, PC A02/MF A01. Order Number DE89001397/JAW.

The Polymeric Ultrathin Films Program (PUFS) was initiated at CD during the Fall of 1984. It is a multidisciplinary program of research and graduate education involving faculty from the Department of Electrical and Computer Engineering (Stephen T. Kowel, Andrew Dienes, and Andre Knoesen), the Department of Chemical Engineering (Pieter Stroeve, Brian G. Higgins, and Robert Powell), the Department of Physics (Lawrence B. Coleman), and the Department of Applied Science (Yin Yeh), and their students. Since the Summer of 1986, a close collaboration has developed with scientists at the Chemistry Division, Naval Weapons Center, China Lake, California. Thus, the program now includes efforts by Dr. Geoffrey Lindsay and a Post Doctoral Fellow, Dr. Robert Hall, in organic and synthetic chemistry, as well as deposition of ultrathin films, evaluation of film properties, and applications work carried out at UCD. The primary focus of our work is film systems for opto-electronics, especially optical signal conditioning, hybrid computing, and sensing. Some project elements devoted to evaluation of optical fibers and planar waveguides are performed by Professor Richard Selfridge in the Department of Electrical and Computer Engineering at Brigham Young University, Provo, Utah. Support has come from the Air Force Weapons Lab-

oratory, Rome Air Development Center, Lawrence Livermore National Laboratory, and the National Science Foundation.

56740 (UCRL—52000-88-7-8) The state of the laboratory: Energy and technology review, July-August 1988. Poggio, A.J.; Hendry, D.P.; Bruner, J.M.; Canada, J.; Clements, W.E.; Crawford, R.B.; de Vore, L.; Gleason, K.; Hendrickson, B.; Sanford, N.M.; Taft, S.O. (eds.). (Lawrence Livermore National Lab., CA (USA)). 1988. Contract W-7405-ENG-48. 102p. NTIS, PC A06/MF A01. Order Number DE89000605/JAW.

The Lawrence Livermore National Laboratory, operated by the University of California for the United States Department of Energy, was established in 1952 to do research on nuclear weapons and magnetic fusion energy. Since then, we have added other major programs, including laser fusion and laser isotope separation, biomedical and environmental sciences and applied energy technology. Our most recent major project, for the Strategic Defense Initiative Organization, is research on the free-electron laser. These programs, in turn, require research in basic scientific disciplines, including chemistry and materials science, computer science and technology, engineering, and physics. The Laboratory also carries out a variety of projects for other federal agencies. Energy and Technology Review is published monthly to report on unclassified work in all our programs.

56741 (EMR—BT31-2/1989-11-13) Energy Mines and Resources Canada, 1988-89 estimates. Part 3, expenditure plan. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada)). 1988. 440p. (In English and French). (MICROLOG—88-02545). Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $20.00 OTHER COUNTRIES $24.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth.

This document provides detail on the Canadian Department of Energy, Mines and Resources and its programs, primarily in terms of the results expected for the money spent. For each program, an expenditure plan is presented which also has an overview section which provides information on key elements of the program's current plans and performance, as well as background information. Supplementary information is provided on the composition of the program's resources which includes additional explanations and analyses. The report is divided into separate sections for the Administrative Program, the Energy Program, and the Minerals and Earth Sciences Program. The Energy Program has the objective to establish and maintain effective policies, strategies and programs for the adequate supply and efficient use of energy resources, with due respect for other social and economic goals. Its activities are in the following specific areas: energy policy; energy commodities; conservation and renewable energy; petroleum ownership, control and incentives; Canadian exploration and development incentives; administration of frontier oil and gas lands; and program support. The Energy Program also administers, in whole or in part, acts and instruments such as the Canada Petroleum Resources Act, the National Energy Board Act, and the Petro-Canada Act. The Minerals and Earth Sciences Program is responsible for activities related to the minerals and metals sector, including surveying and mapping, mineral and energy technology, remote sensing, and polar continental shelf studies. 8 figs., 92 tabs.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 56198, 56298, 56570, 56571, 56574, 56575, 56576, 56577, 56635, 56655, 56680, 56904, 57407

56742 (AD-A—195451/0/XAB) Intermediate-range nuclear forces (INF) treaty: an operational error. Caldwell, W.B. (Army Command and General Staff Coll., Fort Leavenworth, KS (USA). School of Advanced Military Studies). 12 May 1988. 71p. NTIS, PC A04/MF A01.

The purpose of this paper is to examine the operational impact of the INF treaty and what it means for the future of NATO. At this writing, there is considerable debate going on as to whether or not the US Congress should ratify the INF treaty. The political issues are well known and under careful examination. A critical element that still needs to be addressed is the operational impact of the INF treaty. This area may have been neglected because nuclear weapons are viewed primarily as an element of deterrence. Therefore, their warfighting potential is given only minimal consideration. This paper begins with a discussion of the historical use of nuclear weapons in NATO's defensive Alliance. It follows through to the decision in 1979 to modernize NATO's nuclear force. This decision resulted in the deployment of the Pershing II and ground-launched cruise missile (GLCM) systems in Europe. The Soviet warfighting concept for Europe is addressed next to place the intermediate-range nuclear forces in their proper perspective. This is followed by a discussion on the operational implications of the INF treaty. The paper concludes by briefly mentioning a few of the defensive proposals for the post-INF period.

56743 (INIS-mf—11279) Interfaith Program for Public Awareness of Nuclear Issues. Final report. (Interfaith Program for Public Awareness of Nuclear Issues, Toronto, Ontario (Canada). Planning Committee). Nov 1985. 152p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88703585/JAW.

Planning for the Interfaith Progam for Public Awareness of Nuclear Issues (IPPANI) began at the time of the Falkland Islands crisis. At that time representatives of certain of the faith groups in Toronto became concerned about the moral and ethical implications of Canada's export of fuel for a CANDU nuclear generating plant in Argentina. In order to accomplish its goals, the Planning Committee devised a program to provide unbiased input to the faith groups' deliberations on the ethical and moral issues involved in the nuclear debate. The development of a fair set of questions was aided by obtaining advice from the Canadian Nuclear Association (CNA), and from Energy Probe and others. The work of preparing a suitable agenda was completed early in 1984. Its result was embodied in appendices to the public document promoting the program, which is appended to this report. Invitations were sent to over six hundred individuals and organizations to appear before the panelists as 'presenters'. The resulting invitation list included spokespeople for both 'pro' and 'anti' nuclear positions on each of the three topics, as well as some who were found to be 'in the middle'. The three major topics were domestic nuclear issues, international trade and military uses of nuclear materials and technology. The next task of the Planning Committee is that of embodying the process and its results in an educational program for the supplementary and parochial school systems. The production of this book is the first step in that task.

56744 (INIS-mf—11310, pp 37) Methodology of impact assessment in introducing advanced reactor systems. Molin, A. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

56745 (INIS-mf—11824) Nuclear power station. A bomb in disguise? Can it be handled? Justifiable? Economic and safe?. Plettner, B. (Siemens A.G., Muenchen (Germany, F.R.)). Apr 1987. 45p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755287/JAW.

The processes taking place in a nuclear power plant and the dangers arising from a nuclear power station are described. The means and methods of controlling, monitoring, and protecting the plant and things that can go wrong are presented. There is also a short discourse on the research carried out in the USA and Germany, aimed at assessing the risks of utilising nuclear energy by means of the incident tree analysis and probability calculations.

2907 Transport And Storage

REFER ALSO TO CITATION(S) 57434

2910 Conservation

REFER ALSO TO CITATION(S) 56801, 56802, 56820, 56887, 56892

56746 (AFME—85-09-1168) Energy audits in Tunisia - Quotation. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris). Nov 1985. 218p. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88754972/JAW.

A quotation for four industry energy audits in Tunisia through the responsibility of Trans Energ is presented; the objectives of the audits are: analysis of the utilization of energy in the various plants, identification of the various actions to be conducted in order to achieve energetic performance enhancement and preparation of a working program. The four industries concerned are: a fertilizer plant, a cement plant, a textile plant and a brewery.

56747 (CREIC—8601, pp 13) Energy conservation/renewal and the economy. Gestrin, B.V. (Canadian Imperial Bank of Commerce). 1986. CANMET; $0.34CAN per page, $3.40 CAN minimum. (CONF-860124—; CE—01913).

From New energy sources: challenges and business opportunities; Toronto, Ontario, Canada (26 Jan 1986).

This paper reviews the major economic developments in Canada in the past few years and provides an outlook on the Canadian economy as a whole, particularly on the prospects of the energy sector. The main characteristics of these developments include the rise in oil prices, with consequent government incentives to implement energy efficiency, and a subsequent drop in energy demand as part of the inflation of energy costs. The outlook for Canada's renewable energy sector is affected by the slow growth of the Canadian economy and large government deficits which restrict stimulation of the economy by state intervention. Energy prices face downward pressure following the accumulation of supply surpluses; however, a number of other factors are tending to keep energy prices sufficiently high so as to provide an incentive for residential and industrial energy conservation. The implications of these points for the conservation/renewable energy industry are discussed. One is that since energy conservation does not appear to be as high a public priority as it has been in the past, the industry will have to overcome this decline in interest. Canadians will have to be made aware that the energy supply problem has not gone away, and the industry must remember that much of Canada's conservation/renewable energy potential remains unexploited. Public policy makers can help in this by implementing coherent, market-sensitive energy pricing policies and by providing improved public information on conservation/energy substitution opportunities.

56748 (EMR—R8) Zero energy growth for Canada: necessity and opportunity. Brooks, D.B. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada)). May 1976. 40p. (CE—01910). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

In resolving questions about the energy growth rate in Canada, two basic routes are possible: to allow costs and prices to adjust sufficiently to bring supply and demand into balance, presumably at a lower energy growth rate, or to adopt the normative propostion that some explicit choice should be made about target rates of energy consumption. This essay suggests that Canada should follow the latter route and that policies should be adopted to move Canada to a position close to zero energy growth by the year 2000. The thesis is that such a target is both feasible and desirable, with emphasis on the latter. Desirability is defined very broadly to include economic, social and environmental aspects. This essay attempts to answer basic questions about the nature of a low-energy alternative for Canada. In particular, energy conservation is associated with a larger construct called the conserver society, involving goals such as moderation in scale and in rates of change, emphasis on personal contact and community, and maintenance of a wide diversity of people and activities, as well as with the more obvious connotations of reduced material throughput and an improved environment. In this construct, zero energy growth is quite compatible with Canadian conditions that require major attention to space heating and a large transportation sector. Combined with the fact that the energy intended to be conserved includes all non-renewable energy and any other energy produced under capital-intensive, centralized conditions, but not small solar, biomass or wind plants, which can be accepted without destroying the conserver society values, it is felt that there is abundant energy for Canadians to live very well. 41 refs., 3 figs., 3 tabs.

56749 (KTM/E-D—154) Mass communication and household's energy consumption. Uutela, A.; Anttila, U. (Helsinki Univ. (Finland)). (Kauppa-ja Teollisuusministerio, Helsinki (Finland). Energiaosasto). Mar 1988. 50p. (In Finnish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754860/JAW.

The aim of this research is to find out the relations between households' energy consumption and conservation and different kinds of information and feedback methods. This subject has not been investigated in Finland. If a consumer wants to behave in a rational way, it is necessary for one to know enough about the ways the most effective energy conservations may be made. However, such a knowledge does not ensure energy conservation if the consumer is not motivated for energy conservation. The formation of energy conservation motivation is related to the way of life and its changes, social networks and norms, easiness of energy conservation and possibilities to get feedback of one's consumption. Energy conservation continues most probably, if one has consciously decided to conserve energy and this decision is not only enforced by external reasons as economic restrictions. This research leaves quite many fields open for further investigation. So, further research about feedback of households' energy consumption, social networks and incentives of energy conservation programmes is needed. Different scientific desciplines are necessary in investigating these questions. The consumer's position should be related to the whole energy system and one's real possibilities to manipulate energy consumption.

56750 (ORNL/CON—246) Marketing and design of residential energy conservation programs for the elderly. Berry, L.; Schweitzer, M.; Freeman, E. (Oak Ridge National Lab., TN (USA)). Feb 1988. Contract AC05-84OR21400. 220p. NTIS, PC A11/MF A01. Order Number DE88017141/JAW.

This report describes barriers to energy conservation by the elderly. Because of these barriers, they have a greater need for programs that assist with the installation of energy-efficiency improvements. In response to this need, a number of specialized programs are operated for the elderly. This report contains descriptions of 39 energy conservation programs for the elderly. Telephone interviews were conducted with the managers of these programs to identify marketing techniques and organizational structures. Interagency networking, presentations and referrals are the most common methods of recruiting clients. Other marketing techniques in order of the frequency of use are: direct mail, bill inserts, television, radio, printed materials, and telemarketing. Many managers consider word-of-mouth advertising from satisfied clients the most effective form of marketing. Interagency networking and support (financial, structural and in-kind) can offer real advantages in the operation of conservation programs for the elderly. The use of specific marketing techniques is probably less important to success in recruiting clients than the degree of trust potential clients have in the sponsoring organization(s). 4 figs., 10 tabs.

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 56130, 56707, 56748, 56754, 56755, 56767, 56771, 56886, 56887

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 56240, 56289, 56298, 56341, 56358, 56640, 56641, 56642, 56680, 56708, 56709, 56710, 56712, 56713, 56714, 56715, 56717, 56719, 56721, 56741, 56747, 56756, 56768, 56769, 56783, 57552

56751 (APUB—1988) Alberta Public Utilities Board annual report, 1987. (Alberta Public Utilities Board, Edmonton (Canada)). 1988. 76p. (MICROLOG—88-03846). Public Utilities Board for the Province of Alberta, 10055-106th St., 11th Floor, Edmonton, Alta., CAN T5J 2Y2; $N/C; MFCANMET/TID, Energy, Mines and Res. CAN, 555 Booth St.,Ottawa, Ont., CAN K1A 0G1.

The Alberta Public Utilities Board is responsible for regulating all telecommunications, electric, water and gas utilities in Alberta, with certain exceptions, such as municipally owned utilities. The Board's primary purpose in regulating utilities under its jurisdiction is to ensure that the utilities' customers receive safe and adequate service at rates which are just and reasonable to both the customers and investors of those utilities. As part of the regulatory process, the Board is responsible for reviewing the affairs, earnings or accounts of public utilities, and for exercising general supervision of such utilities and ensuring their compliance with the law. The Board has also been assigned a number of other regulatory responsibilities, including: pricing and rate determination and arbitration; conducting hearings; approving franchise agreements, supply contracts and taxation agreements between municipal councils and utilities; serving as an appellate tribunal with respect to certain disputes involving gas transportation; performing compensation fixing duties with respect to pollution and environmental damage claims; and approval of tariffs and tolls of intraprovincial railways. The Board may also be directed to hold inquiries into areas under its jurisdiction and report thereon. This report outlines the Board's activities for the year and includes summaries of hearings, inquiries, applications, appeals, decisions, and related matters.

56752 (EMR—EP80-4E) The National Energy Program, 1980. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada)). 1980. 115p. (CE—01905). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report describes the Canadian government's program intended to achieve the objectives of: ensuring security of security of energy supplies and ultimate indepeadence from the world oil market; providing Canadians an opportunity to participate and share in the benefits of the energy industry; and establishing a fair petroleum pricing and revenue-sharing regime. The report begins with a discussion of the major problems in Canada's energy situation. The international oil market, the Canadian role as a net energy exporter, the availability of different energy options for Canada's energy future, the imbalance in petroleum revenues within Canada, resource ownership, and the financial status of resource industries are all influential factors. Specific elements of the program to deal with these problems are then summarized. A central issue is oil prices; a new blended price system run by a Petroleum Incentives Board is established. New structures for energy taxes and revenue sharing are presented, with the objective of providing sufficient incentive to the industry and creating a more balanced framework for inter-governmental revenue sharing. The legal framework of the lands under federal jurisdiction is being revised to reflect current energy realities. Provisions are made for increasing Canadian ownership of the oil and gas industry. To decrease dependence on oil, a number of specific initiatives are proposed for oil substitution, efficient oil use, energy conservation, renewable energy, and research programs. Specific concerns of the regions are addressed, notably the west and the Atlantic region. Costs and projected impact of the program are also discussed. 17 figs., 22 tabs.

56753 (KTM/E-B—67) Energy policy and the opinion leaders and the decision makers in Finland. Ruostesaari, I. (Tampereen Yliopisto, Tampere (Finland)). (Kauppa-ja Teollisuusministerio, Helsinki (Finland). Energiaosasto). Nov 1987. 179p. (In Finnish). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88754858/JAW.

The present study analyses the formation of Finland's energy policy using governmental structure and elite research as a frame of reference. The main object of this study is to outline the network structure of the opinion leaders and of the overall interaction around the energy question. In other words, the purpose is to analyse those organizations and persons who in recent years have most deeply influenced on the formation of energy policy and on its decision making processes. The present study is in three parts. In the first part (Chapters 3-4) the structure of the interaction around the energy question and the network structure of the opinion leaders and the decision makers is outlined using mainly formal criteria. Chapter 3 studies the extent of participation in the formation of the national energy policy. In other words, the question is what bodies have participated through committee system in the formation o the energy policy and to what extent. In Chapter 4 the interrelationships of the various energy organizations are described using the so called interlocking directors method. In short, the first main part of the study looks for those organizations and persons who through their official position have either participated in the forming of the energy policy or have influenced on it. The second main part tries to indicate to what extent the above mentioned organizations and persons have real influence on the energy policy. Here the expert method is used. Also the roles which mass media, research work, and informal communication play in the energy policy are analysed here. In the third main part the energy policy's top elite is defined on the basis of the previous analyses. At the end a pattern based on the subsystems has been outlined to clarify the mechanism by which Finland's energy policy is formed.

56754 (NEB-SS—NE1-1987E) National Energy Board annual report, 1987. (National Energy Board, Ottawa, Ontario (Canada)). 1987. 98p. (MICROLOG—88-03922). National Energy Board, Regulatory Support Office, 473 Albert Street, Ottawa, Ont., Canada K1A 0E5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The National Energy Board is a Canadian federal regulatory tribunal whose powers include the licensing of oil, natural gas, and electricity exports, the certification of interprovincial and international power lines, and the setting of tolls and tariffs for oil and gas pipelines under federal jurisdiction. The Board also keeps under review the Canadian supply of all major energy commodities, with emphasis on electricity, oil, natural gas, and the by-products derived from oil and natural gas, as well as the demand for Canadian energy in Canadian and export markets. The Board also has responsibilities under the Northern Pipeline Act and the Energy Administration Act. This report reviews the year's activities of the Board and also presents a review of energy developments in Canada, such as energy production and consumption, exports, and reserves. As part of the Board's activities, hearings are conducted on various matters and the major decisions, and information on applications to the Board, are summarized. The changes made during the year to the acts, regulations, and rules under which the Board operates are also given.

56755 (NEB-SS—NE1-1987F) National Energy Board annual report, 1987. (National Energy Board, Ottawa, Ontario (Canada)). 1987. 89p. (In French). (MICROLOG—88-03923). National Energy Board, Regulatory Support Office, 473 Albert Street, Ottawa, Ont., Canada K1A 0E5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The National Energy Board is a Canadian federal regulatory tribunal whose powers include the licensing of oil, natural gas, and electricity exports, the certification of interprovincial and international power lines, and the setting of tolls and tariffs for oil and gas pipelines under federal jurisdiction. The Board also keeps under review the Canadian supply of all major energy commodities, with

emphasis on electricity, oil, natural gas, and the by-products derived from oil and natural gas, as well as the demand for Canadian energy in Canadian and export markets. The Board also has responsibilities under the Northern Pipeline Act and the Energy Administration Act. This report reviews the year's activities of the Board and also presents a review of energy developments in Canada, such as energy production and consumption, exports, and reserves. As part of the Board's activities, hearings are conducted on various matters and the major decisions, and information on applications to the Board, are summarized. The changes made during the year to the acts, regulations, and rules under which the Board operates are also given.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 56009, 56096, 56099, 56130, 56131, 56132, 56133, 56165, 56525, 56732, 56751, 56764, 56767

56756 **(AD-A—195309/0/XAB) Oil and power: an analysis of United States economic interests and strategies in the Middle East. Study project.** Poche, C.D. (Army War Coll., Carlisle Barracks, PA (USA)). 31 May 1988. 45p. NTIS, PC A03/MF A01.

The United States met virtually all of its oil needs from domestic sources until the early 1970s. This self-sufficiency gradually eroded as our internal production failed to keep pace with rising levels of energy consumption. As a result, our new energy needs have been satisfied primarily by petroleum imports. The 1973 Arab oil embargo and supply curtailments associated with the Iranian Revolution in 1979 were painful experiences for the nation. By 1980, the United States was importing 8.5 million barrels of oil per day at a cost many times higher than the going rate in earlier years. Dependence on Middle East oil had become a frightening reality. During the same period, trade deficits, inflation, interest rates, and balance of payment problems were increasing at an alarming rate. Since that point in time, the United States has made progress in building a strong foundation for energy security. Despite these gains the United States is rapidly approaching another critical juncture in its battle to reduce dependency on imported oil. It also suggests national economic strategies that could be employed to improve America's energy prospects for the future.

56757 **(PB—88-234539/XAB) Parametric study of the undiscovered resource base: recommended for enhancing the GRI (Gas Research Institute) baseline projection.** (Lewin and Associates, Inc., Washington, DC (USA)). 15 Jul 1986. 454p. NTIS, PC E99/MF E99.

Set includes PB—88-234547 through PB—88-234570.

A separate abstract is included for each of the 4 volumes of this set.

56758 **(PB—88-234547/XAB) Parametric study of the undiscovered resource base: recommendations for enhancing the GRI (Gas Research Institute) baseline projection. Volume 1. Detailed study of the permian Basin. Final report, 1984-1986.** Morra, F. (Lewin and Associates, Inc., Washington, DC (USA)). 15 Jul 1986. 115p. NTIS, PC A06/MF A01.

See also Volume 2, PB—88-234554; Also available in set of 4 reports PC E99, PB—88-124539.

This report is a part of a four-volume analysis of the resource-base assumptions used by the GRI Hydrocarbon Supply Model. This volume provides a detailed comparison of the GRI Model with other contemporary estimates of resource in the Permian Basin (Southwest Texas and Eastern New Mexico). Topics treated are: review of methods used in resource estimation (historical/empirical and geological/judgemental); review of Hydrocarbon Model analysis methodology and data base; review of an alternate estimate prepared by the Colorado School of Mines (CSM); and comparison of resource estimates and field-size distributions with other published sources.

56759 **(PB—88-234554/XAB) Parametric study of the undiscovered resource base: recommendations for enhancing the GRI (Gas Research Institute) baseline projection. Volume 2. Lower-48 onshore resource base comparison. Final report.** Morra, F. (Lewin and Associates, Inc., Washington, DC (USA)). 15 Jul 1986. 114p. NTIS, PC A06/MF A01.

See also Volume 1, PB—88-234547, and Volume 3, PB—88-234562; Also available in set of 4 reports PC E99, PB—88-234539.

This report is part of a four-volume set that analyzes the resource-base assumptions of the GRI Hydrocarbon Supply Model. In this volume, the estimates of known and undiscovered resource are reviewed in detail in ten Lower-48 onshore basins. Oil- and gas-resource base assumptions of the GRI Model are compared with: a special analysis made by the Colorado School of Mines using data from the Potential Gas Committee; and USGS Circular 860. The report contains a general assessment and detailed observations about each of the ten regions.

56760 **(PB—88-234562/XAB) Parametric study of the undiscovered resource base: recommendations for enhancing the GRI (Gas Research Institute) baseline projection. Volume 3. Allocation of the gas resource base by size of accumulations and deliverability. Final report, 1984-1986.** Morra, F. (Lewin and Associates, Inc., Washington, DC (USA)). 15 Jul 1986. 185p. NTIS, PC A09/MF A01.

See also Volume 2, PB—88-234554 and PB—88-234570; Also available in set of 4 reports PC E99, PB—88-234539.

This report is part of a four-volume set that investigates the resource-base assumptions of the GRI Hydrocarbon Supply Model. The volume focuses on the tight gas resource and provides a mechanism for GRI to explicitly represent the resource within the Hydrocarbon Model. This study reports on: the number of known and undiscovered tight-gas fields which may be included without differentiation in the Hydrocarbon Model; an independent assessment of the distribution of the known and undiscovered tight gas resource by field size, using contemporary information; and an estimate of the size of the total tight-gas resource, including estimates of the overlap between tight and non-tight resource in current resource estimates.

56761 **(PB—88-234570/XAB) Parametric study of the undiscovered resource base: recommendations for enhancing the GRI (Gas Research Institute) baseline projection. Executive Summary. Final report, 1984-1986.** Morra, F. (Lewin and Associates, Inc., Washington, DC (USA)). 15 Jul 1986. 40p. NTIS, PC A03/MF A01.

See also Volume 3, PB—88-234562; Also available in set of 4 reports PC E99, PB—88-234539.

This is the executive summary of a detailed analysis of the resource-base assumptions used by GRI's Hydrocarbon Supply Model in making the annual baseline forecast. The analysis was conducted over a two-year period, and is reported in a four-volume set, including the executive summary and three supporting analysis volumes. The study treats three major topics: data on known oil and gas fields; estimates of undiscovered resource, by field size; and disaggregation of conventional and tight-gas resource. The study makes several recommendations for strengthening and enhancing the GRI baseline forecast.

56762 **(PB—88-235593/XAB) Toxic substances list, 1974 edition.** Christensen, H.E.; Luginbyhl, T.T. (Tracor JITCO, Inc., Rockville, MD (USA)). Jun 1974. 988p. (DHEW/PUB/NIOSH—74-134). NTIS, PC A99/MF E06.

See also PB—88-235585.

The 1974 edition of the Toxic Substances List is the third revision of the list of toxic substances prepared at least annually in accordance with Section 20(a)(6) of the Occupational Safety and Health Act of 1970, Public Law 91-596. The List includes the original list published in June 1971 and the offerings of the subsequent publications. The list contains 42,000 listings of chemical substances: 13,000 are names of different chemicals with qualifying toxic dose information and 29,000 consist of synonymous names and codes. The revision contains approximately 5,000 new compounds which had not appeared in the 1973 edition. Specific data are provided on the toxicity of each substance related to: route of administration, animal species involved, type of exposure reported (e.g.

lethal), dose which caused toxic response, and body system affected. The bibliographical sources from which the toxicity data were extracted are all listed. Absence of a substance does not imply that it is innocuous.

2950 Hydrogen And Synthetic Fuels

56763 (CREIC—8601, pp 7) **Marketing opportunities for renewable fuel ethanol from the prespective of St. Lawrence Reactors Ltd.** Smith, B.S. (St. Lawrence Reactors Ltd., Mississauga, Ont.). 1986. CANMET; $0.34CAN per page, $3.40 CAN minimum. (CONF-860124—; CE—01913).

From New energy sources: challenges and business opportunities; Toronto, Ontario, Canada (26 Jan 1986).

The objective of this paper is to analyze the Canadian market opportunities for fuel ethanol made from renewable resources. A history of the fuel ethanol industry, and a history of a Canadian company involved in this field, is presented. This company has structured its business development and marketing activities in order to take advantage of this new market. The benefits of a domestic Canadian fuel ethanol program are outlined; these include the providing of an alternative transportation fuel which is not based on petroleum or natural gas; the opportunity to use up agricultural wastes; and the opportunity to have an environmentally safe source of octane enhancement. The development of the fuel ethanol industry in Canada is felt to have several key elements: use of ethanol as a co-solvent for methanol; marketing of methanol/ethanol blends as octane enhancers to major refineries; building base fuel ethanol plants on cost-effective technology; and maintenance of a long term perspective. Potential market in Ontario for gasoline with 10% ethanol-methanol blend could reach 50% of all gasoline sold by 2000, if sufficient plant capacity, and sufficient economic incentives, are developed. Ethanol's competitive position will depend on price; without subsidies, current selling price in Canada is about $0.44/l. At this price, ethanol-methanol-gasoline blends are competitive. To achieve high market penetration, the cost will have to come down; new technology being developed and the integration of lower cost feedstocks are forecast to lower the price in constant dollars to $0.35/l by 1990. The competitive position of ethanol will also depend on other fuel prices.

56764 **(GERAD—G-85-24) Energy supply technologies in MARKAL-QUEBEC.** Savard, G. (GERAD Ecole des Hautes Etudes Commerciales, Montreal, Quebec (Canada)). Dec 1985. 65p. (In French). (CE—01947). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

MARKAL-QUEBEC is a linear programming model whose purpose is to optimize the evolution of the means of production, transformation and utilization of various forms of energy, in order to satisfy a variety of useful external demands. This report presents the technologies for energy transformation which produce a form of energy other than low temperature heat or electricity. The report analyzes these technologies as a whole, excluding those directly associated with the industrial sector, transportation, and refining. It has been written to present and document these technologies for the MARKAL-QUEBEC data bank, giving their principal parameters and characteristics, techniques and economics, which are of use to modelers. The specific forms of energy analyzed are the alcohols, hydrogen, liquefied and compressed natural gas, C3-C4 olefins, Mobil-process fuel, and nuclear products. Tables for use with the MARKAL model are included. 40 refs., 14 figs., 13 tabs.

2960 Electric Power

REFER ALSO TO CITATION(S) 56390, 56391, 56395, 56463, 56524, 56751, 56790, 58280

56765 **(AD-A—194907/2/XAB) Black Hills versus Weinberger: how useful is it for other Air Force bases to competitively acquire electricity. Student report.** Lawler, B.T. (Air Command and Staff Coll., Maxwell AFB, AL (USA)). Apr 1988. 37p. (ACSC—88-1540). NTIS, PC A03/MF A01.

It appears the Air Force will have to live with tighter budgets over the next several years. Therefore, ways to save money that do not compromise the mission are needed. One way to accomplish this is to compete for utility services. The Air Force spends over $1 billion a year for utilities, and about $550,000,000 for electricity alone. In 1984 Ellsworth AFB, South Dakota competed for a portion of its electric-power needs. As of 30 September 1987, the base had saved over $890,000 because of this competitive effort. This competitive effort resulted in litigation on the issue of whether an Air Force base is required to follow state-created utility-franchise arrangements. The Air Force won this litigation. The purpose of this paper is to analyze the court case approving Ellsworth's electric competition, and to determine the usefulness of this case for other Air Force bases. If the Ellsworth example could be applied at other bases, the Air Force would realize tremendous savings. However, this case presented some rather unique facts that will limit its usefulness.

56766 (CREIC—8601, pp 8) **Canadian electric utilities and renewable energy.** Miller, H.D. (Representative, Canadian Electrical Association, Montreal, Que.). 1986. CANMET; $0.34CAN per page, $3.40 CAN minimum. (CONF-860124—; CE—01913).

From New energy sources: challenges and business opportunities; Toronto, Ontario, Canada (26 Jan 1986).

This paper outlines a few of the renewable energy projects being undertaken in Canada by electric utilities and some first hand experience of an Alberta utility in this regard. Interconnection policies with small energy producers are discussed, including rate derivation, technical requirements, safety, cost of developing small power systems, and the effects on a utility's load factor. The Alberta experience mentioned concerns the interconnection of a wind turbine unit and a pricing policy utilizing an energy banking concept.

56767 **(DOE/EIA—0348(87)) Electric power annual, 1987.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 26 Sep 1988. 149p. NTIS, PC A07/MF A01 - GPO. Order Number DE89001020/JAW.

The Electric Power Annual (EPA) is prepared by the Electric Power Division, Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Information Administration, US Department of Energy. The EPA provides information about electric power for a wide audience, which includes electric utilities, industry, consumers, educational institutions, and government. The EPA presents an annual summary of electric utility statistics at the national, regional, and state levels from 1983 through 1987. Each section contains related text, tables, and graphs. Sections on net generation, fuel consumption, and receipts present data at the regional level. All sections present census division and state totals. Data are also aggregated in a US summary and by North American Electric Reliability Council (NERC) region. The EPA represents the most current annual data and the best appraisal of the electric utility industry available to the Energy Information Administration (EIA). Statistics presented herein may differ from those published in earlier reports because of revised data bases, definitions, or calculation methods. Refer to the "Technical Notes" at the back of this report for an explanation of individual definitions or methods of calculation. The EPA routinely uses regional definitions developed by other organizations such as the Bureau of the Census and the NERC. While the regional definitions used are consistent, data reported herein may differ from those reported by other organizations because respondent definitions, reporting periods, or methods of calculations differ. 20 figs., 94 tabs.

56768 **(GB—63) Regulating for efficiency.** (Association for the Conservation of Energy, London (UK)). [1988]. 22p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754984/JAW.

In view of the impending electricity privatization in the UK, an article is presented on the experience in the USA of the regulation systems. It is concluded that there is a strong correlation between States where powerful interventionist and purposeful regulatory authorities operate and the existence of efficient electric and gas utilities. The converse appears to be even more true: weak, hands-off regulation has permitted costly inefficiencies to the detriment of customers and share holders. (U.K.).

56769 **(MEA—8703) The Manitoba Energy Authority annual report year ending March 31, 1987.** (Manitoba Energy Authority, Winnipeg (Canada)). 1987. 25p. (MICROLOG—88-03829). Manitoba Energy Authority, 607-330 Graham Ave., Winnipeg, Man., Canada R3C 4A5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Manitoba Energy Authority is responsible for developing and implementing policies to ensure the long-term stability and availability of electrical energy supply to Manitobans. It is also responsible, through its Electrical Energy Marketing Committee, for negotiating export sales of electrical energy with other provincial utilities and with utililities in the USA. It is further responsible for promoting the establishment, development and operation of energy intensive industries within the province, and for coordinating all departmental and Manitoba Hydro activities related to industrial and employment benefits associated with the Limestone Generating Station Project. This report presents a summary of the Authority's activities for the year, including export agreements and negotiations and the associated sales figures. Financial statements of the Authority are also included.

56770 **(NLH—1987) Newfoundland and Labrador Hydro annual report, 1987.** (Newfoundland and Labrador Hydra, St. John's (Canada)). 1987. 33p. (MICROLOG—88-03924). Newfoundland and Labrador Hydro, Philip Pl., Elizabeth Ave., St. John's, Nfld., CAN A1A 2X8; $N/C; MF CANMET/TID, Energy, Mines and Resources CAN, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $1 CAN.

The Newfoundland and Labrador Hydro group of companies provide electrical power and energy to the province and for export, through its electrical generation, transmission and distribution facilities. Most of the power on the island of Newfoundland is produced from hydroelectric stations, the reminder from thermal power plants. Operational services are also provided to the rural electrification program. In addition, the Hydro group engages in energy planning in order to meet future demand for electricity. In Labrador, the Churchill Falls Corporation generates hydroelectric power, mainly for export to Quebec, with the rest going to local domestic and industrial users. This report reviews the Hydro group's activities for the year, in the areas of operations, engineering, construction, employee relations, rates, corporate services, and finances. Financial statements are also included.

56771 **(OH/EF—8805) [Ontario Hydro] Load forecast report, No. 871214. System demands.** (Ontario Hydro, Toronto (Canada). Economics and Forecast Div.). May 1988. 84p. (MICROLOG—88-04233). Ontario Hydro, Economics and Forecasts Division, 700 University Avenue, Toronto, Ont., CAN M5G 1X6; $N/C; MF CANMET/TID, Energy, Mines and Res. CAN, 555 Booth St.,Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A short-term load forecast for Ontario Hydro, 1987-1992, is presented, prepared using the results of: a customer survey; updated economic forecasts; electricity demand forecast models relying on the most recent data; the latest analysis of the deviations of recent Ontario electricity demands from last year's predictions; and a revised forecast of indirect incentives. Also provided is a brief commentary on considerations affecting the forecast, such as the economic outlook, future electricity price levels, weather effects, and the amount of electricity attributed to unallocated load and transmission losses. Analysis of the performance of last year's forecast, a description of the short-term forecasting models used, and the forecast of capacity interruptible loads are also given. A long-term load forecast for 1993-2010 was derived taking into account the short-term forecast, long-term economic outlook, various model estimates and other factors. The presentation is similar to that for the short term forecast. It includes the results of two different approaches to forecasting, the econometric and end-use models, as well as two approaches to describing forecast uncertainty. An amount has been subtracted from both forecasts to show effects of indirect incentives (marketing programs using financial incentives to alter load level and shape) on total system demand. The resulting forecast is the Primary Load Forecast, which has a role in the planning process as being the most likely projection of the load that the utility must plan to supply. In 2010, this is expected to be 201.4 TWh, compared with the basic level (without incentives) of 209.5 TWh. 15 figs., 53 tabs.

56772 **(PB—88-232038/XAB) Special issue: electricity distribution in the Netherlands in 2010: the case of an all-electric residential area.** Jansen, W.J.L. (Keuring van Electrotechnische Materialen N.V., Arnhem (Netherlands)). 1988. 43p. NTIS, PC E03/MF A01.

Pub. in Kema Scientific and Technical Reports, Vol. 6, No. 3, 69-111(1988). See also PB—87-193199.

Contents include: electricity distribution in the netherlands in 2010 - the case of an all residential area; energy conservation leading to other public utilities; houses and the residential area in the year 2010; the future energy requirement of households for lighting and appliances; the total energy demand in the all electric house of 2010, and electricity load management for households in 2010.

56773 **(RISO-M—2698) Electricity demand patterns on Anholt. A small island without connection to the main power grid.** Aagaard Madsen, H.; Fenhann, J.; Greisen, H.; Troest Nielsen, H. (Risoe National Lab., Roskilde (Denmark)). Mar 1988. 54p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754881/JAW.

This report contains the results from a study of the electricity demand made at the island of Anholt during 1984 and 1985. During 3 weeks in March 1985 measurements of power and reactive power demand was made with timesteps of 1 second. These data together with existing data for 1984 was analysed in order to examine the variations in the power demand, short time as well as long time variation, which are of great importance in the analysis and design of wind/diesel systems. The island of Anholt is of special interest because it is without connection to the main Danish grid and because it has been considered to install a wind/diesel system here. The technical data and the operation of the existing power station at Anholt are described in appendix A. Appendix B contains a set of curves showing the daily variations in power demand. 44 ills., 10 refs.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 56099, 56767, 56802

56774 **(DOE/BP—946) Financial highlights: Annual report 1987.** (Bonneville Power Administration, Portland, OR (USA)). Feb 1988. 56p. NTIS, PC A04. Order Number DE89001543/JAW.

Federal Columbia River Power System for the fiscal year ended September 30, 1987. This report covers: Financial highlights; Letter to the Secretary; The Financial Year in Review; Power Sales; Meeting the Region's Power Needs; Building for the Future; Regional Operations; BPA, the Council and Fish; 50th Anniversary; New Headquarters Building; Energizing the Community; Financial Section; Auditor's Report; and Financial Statements.

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 56511, 56766

56775 (CREIC—8601, pp 3) **Establishing a Canadian presence in the world's photovoltaic marketplace.** Thomas, R.E. (TPK Solar Systems, Inc., Nepean, Ont.). 1986. CANMET; $0.34CAN per page, $3.40 CAN minimum. (CONF-860124—; CE—01913).

From New energy sources: challenges and business opportunities; Toronto, Ontario, Canada (26 Jan 1986).

This paper presents the views of a Canadian company that has found a market niche for its photovoltaic products in the developing countries. Photovoltaic systems have been sought by developing countries through aid programs, and the largest share of this market has tended to go to the big producers who can produce at economies of scale. In some countries, national priority is given to photovoltaics produced within their own boundaries. The effect of this has been to close off the end-product market to outside

sources, but to open a market for photovoltaic production equipment and technology. Such equipment, including a laminator for encapsulating solar cells against the environment, was developed, and complete integrated solar cell and module production plants have been sold to India and China. New equipment developed since then has included automated screen printing lines for printing contacts on solar cells, cell interconnecting equipment, and testing equipment. A strong Canadian presence in this market niche has therefore been established.

56776 (CREIC—8601, pp 4) **Alternative energy resources in the Caribbean.** Platts, R.E. 1986. CANMET; $0.34CAN per page, $3.40 CAN minimum. (CONF-860124—; CE—01913).

From New energy sources: challenges and business opportunities; Toronto, Ontario, Canada (26 Jan 1986).

This paper examines the energy needs and potential for application of renewable energy sources in the Caribbean countries. For most of these countries, energy is oil based, with consequent high costs. Their small size tends to mean such energy is inefficiently used, partly due to an inability to use economies of scale. Uses of this energy include transport fuel, low-grade energy for crop drying and industrial processes, and diesel electric power generation. Overall, little electricity is used, or available, yet the electricity cost is disproportionately high. Trinidad, with its oil resources, is an exception. Nevertheless, all the islands have possible alternative energy sources that have not been exploited to any great extent. 1 fig.

56777 (CREIC—8601, pp 8) **Market potential for renewable energy. An international perspective.** McKay, J.W. (Solace Micropower Engineering, Vancouver, B.C.). 1986. CANMET; $0.34CAN per page, $3.40 CAN minimum. (CONF-860124—; CE—01913).

From New energy sources: challenges and business opportunities; Toronto, Ontario, Canada (26 Jan 1986).

This paper examines Canada's potential markets in other countries for renewable energy products. In the developing world, climatic and economic conditions can permit much higher margins of cost-effectiveness for renewable energy systems and thus provide market opportunities that do not exist in the climatic and economic conditions prevalent in Canada. Examples of such conditions are given in this paper, and they include countries with high fuel or utility prices, and countries where solar or wind energy is found in great abundance. Other considerations in penetrating this market are discussed; these include maintenance of energy facilities, legal aspects, communications and transportation problems, and availability of financing. The role of aid agencies in the latter regard is outlined. Target markets are identified, and possiblilities include small hydro, solar, and wind power generation in the Caribbean, and solar air conditioning in India. 3 refs.

56778 (CREIC—8601, pp 7) **Renewable energy: the nature and scope of the business opportunity.** Brookes, D.B. (Marbek Resource Consultants Ltd., Ottawa, Ont.). 1986. CANMET; $0.34CAN per page, $3.40 minimum. (CONF-860124—; CE—01913).

From New energy sources: challenges and business opportunities; Toronto, Ontario, Canada (26 Jan 1986).

This paper begins by summarizing the results of an earlier study on the feasibility of a renewable energy path for the Canadian economy. The results show that it would be technically feasible to run the Canadian economy in 2000 with only 4% more energy than it used in 1978 and to double the reliance on renewable sources from 16% to 32% during the same period. This scenario assumes strong economic growth and moderate population growth; under more moderate economic growth, it would be feasable to use 22% less secondary energy over the above time period, with 45% of that energy provided by renewable sources, assuming a decrease in the real cost of renewable energy technologies. Other projections were made for the size of the market for renewable energy, and possible sources and uses. The paper then discusses the possible lessons from this earlier study. These include the following: there is an important, but very diverse, market for renewable energy; industry has too often overstated the market potential, mainly because it has neglected conservation as an alternative option; the conservation market, in combination with renewables, will be an important challenge; the near-term market opportunity for renewables is limited by inappropriate government policies and by inadequate information and education; and, environmental attractiveness is an important advantage of renewable energy sources. 4 refs.

56779 (CREIC—8601, pp 5) **Competition among banks.** Kazman, J.A. (Continental Illinois Bank (Canada), Toronto, Ont.). 1986. CANMET; $0.34CAN per page, $3.40 CAN minimum. (CONF-860124—; CE—01913).

From New energy sources: challenges and business opportunities; Toronto, Ontario, Canada (26 Jan 1986).

This paper outlines the Canadian banking market, and suggests some logical starting points for seeking bank financing of renewable energy projects. The role of banks in financing these projects is examined. The key issues of interest to a prospective lender are reviewed. Aside from normal financial criteria such as projected cash flow and payback period, the main risks examined by lenders are listed. Pre-completion risks include: technological risks, where the credibility of a project can be enhanced if it uses a known and proven technology; construction cost overrun risk; and performance specification risk, i.e. that a proposed project may not perform to specification on completion. Major post-completion risks include: the marketability of the energy produced; the availability and price volatility of fuel, in the case of fuel-burning projects; operational and maintenance cost problems, such as equipment failures and interruptions; availability and skill of personnel to operate the project; risk of change in the regulatory environment; and possible changes in interest rates. A focused approach and a detailed presentation addressing the economics and the risks of the project will greatly assist in seeking bank financing for renewable energy projects.

56780 (CREIC—8601, pp 3) **The myth is the truth: new energy sources and public policy.** Efford, I.E. (Avocet International Ltd., Ottawa, Ont.). 1986. CANMET; $0.34CAN per page, $3.40 CAN minimum. (CONF-860124—; CE—01913).

From New energy sources: challenges and business opportunities; Toronto, Ontario, Canada (26 Jan 1986).

This paper discusses the attitudes of Canadian universities, governments, and industry to new energy sources and how these attitudes are affecting public policy in this area. Universities are felt to have a low level of interest in research into new energy sources, and to perform research of uneven quality or marginal relevance. Government agencies generally do better research but are felt to lack sufficient practical knowledge and experience in business to be able to develop policies which would have long term success. The new energy source industry has the problem of diversity and lack of cohesion, leading to little real influence with governments or other businesses. Common to all three sectors is their relative isolation from one another with a consequent lack of interest and lack of communication with the other sectors.

56781 (CREIC—8601, pp 8) **Leasing.** Hawken, E.F. (Commerce Leasing Ltd., Toronto, Ont.). 1986. CANMET; $0.34CAN per page, $3.40 CAN minimum. (CONF-860124—; CE—01913).

From New energy sources: challenges and business opportunities; Toronto, Ontario, Canada (26 Jan 1986).

This paper gives an overview of leasing as applicable to the financing of renewable/alternate energy projects in Canada. Leases may be structured in a variety of ways, and the tax advantages/disadvantages of leasing are discussed. Mention is made of the tax validity of leasing and the ability of the parties involved to deduct rental payments as a business expense or to use capital cost allowances. In the context of energy project financing, the long life of typical project facilities introduces difficulties. Under present tax rules, transferring title to the lessee after the lessor has recovered his investment and the required return could render the lease arrangement invalid for tax purposes. This would have the result that the lessor could not claim the capital cost allowance that had already been factored into the pricing of the lease. Possible solutions include structuring the lease to allow transferring of the lessor's interest to a third party at the end of the initial lease term. Leasing is also discussed as a means for financing large projects. Leveraged leasing, where the financier can obtain full ownership of the equip-

ment and accordingly the full tax benefits of ownership without paying the full cost, provides benefits to the financier through the earnings from the investment of the deferred taxes. This paper concludes with a presentation of the advantages and disadvantages of leasing, and the possible risks for the parties involved.

56782 (CREIC—8601, pp 7) **Third party financing.** Shepherd, J.C. (Blaney, McMurtry, Aarons & Watson, Toronto, Ont.). 1986. CANMET; $0.34CAN per page, $3.40 CAN minimum. (CONF-860124—; CE—01913).

From New energy sources: challenges and business opportunities; Toronto, Ontario, Canada (26 Jan 1986).

Alternate energy companies seeking financing from third parties can direct their attention to the funding for sales of their product to users, or to the provision of working capital. Whether the funding relates to sales or operations, the parameters under which the financier operates will be much the same. These include security of funds supplied, rate of return, and net cash flow. In both the funding of installations and the funding of companies, there are basically 3 types of financiers to whom alternate energy companies can look: conventional lenders, investors and venture capitalists, and high-income taxpayers. While each of these groups is a possible source of funds in any given case, the structure of an investment that will attract any one of them will not likely attract the others. The goal of this paper is to give a brief overview of the priorities of each type of investor, and the structures that tend to meet those priorities. It is shown that a creative approach to raising capital can produce a broad range of options that are not immediately apparent when financing is first thought of. By looking at the parameters under which the particular types of financiers operate, it is possible to create a structure that suits a specific financing source, and to increase the chance of success in financing from that source.

56783 (CREIC—8601, pp 10) **Tax incentives/class 34.** Binavince, E.S. (Gowling & Henderson, Ottawa, Ont.). 1986. CANMET; $0.34CAN per page, $3.40 CAN minimum. (CONF-860124—; CE—01913).

From New energy sources: challenges and business opportunities; Toronto, Ontario, Canada (26 Jan 1986).

This paper presents a discussion of the Canadian tax incentives relevant to the development of new energy sources. The lack of tax incentives to develop such sources is explained as a result of earlier federal policies. The overall approach to tax incentives is evaluated with reference to what can be learned from the USA and from earlier Canadian policies. Broadly speaking, the policy of incentives can be achieved through either transfer payments or tax expenditures, with the former being the preferred approach in Canada. The nearest comparison in Canada to the incentive schemes for new energy sources as found in the USA is the capital cost allowance claimable under Class 34 of the Income Tax Regulations, which deals with equipment that contributes to the efficient use of energy resources. The rule generates a maximum writeoff of 25% in the year of acquistion, 50% in the year following, and the balance in any subsequent year. Generally, the kinds of equipment that can be included in this class are such items as: electrical generating equipment which is part of a plan to produce heat to generate power or to recover waste heat; solar heating equipment; a hydroelectric installation of an existing hydro energy producer; and heat recovery equipment. The specialized and limited scope of this class requires careful consideration by those engaged in electrical generation and heat generation or recovery.

56784 (CREIC—8601, pp 6) **Alternate Energy Development Program (AEDP).** 1986. CANMET; $0.34CAN per page, $3.40 CAN minimum. (CONF-860124—; CE—01913).

From New energy sources: challenges and business opportunities; Toronto, Ontario, Canada (26 Jan 1986).

This document outlines policies and programs under the Renewable Energy Division of Energy, Mines and Resources Canada. Criteria for eligibility, types of assistance available, and examples of recent projects are given. Specific program areas are: alternate energy development for Prince Edward Island; bioenergy development, aimed at substituting biomass for non-renewable fuels and chemicals; solar energy development, including small hydro and wind energy, and applications relevant to both domestic and industrial/commercial uses; and a demonstration program for promoting off-oil energy alternatives and conservation options for remote communities.

56785 (CREIC—8601) **New energy sources challenges & business opportunities.** (Conservation/Renewable Energy Industry Council, Ottawa, Ontario (Canada)). 1986. Vp. (CONF-860124—; CE—01913). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

From New energy sources: challenges and business opportunities; Toronto, Ontario, Canada (26 Jan 1986).

A conference was held to examine alternate energy sources, and papers were presented reviewing technology, financial and business aspects, and public policy aspects. Specific topics included small hydro, wind power, bioenergy and liquid fuels, solar thermal projects, photovoltaics, financing, leasing, tax policy, industrial and institutional initiatives, electric utilities and small power generation, and fuel ethanol production. Separate abstracts have been prepared for fifteen papers from this conference.

56786 **(PB—88-233929/XAB) Woody biomass energy resources of Illinois. Final report.** Burnett, C.D. (Illinois Inst. of Natural Resources, Champaign (USA). Illinois Natural History Survey). May 1988. 90p. NTIS, PC A05/MF A01.

The potential of woody biomass for energy production in Illinois was examined at four geographic scales. At the statewide scale, the geographic distribution of the aboveground woody biomass resource was mapped by the choropleth, perspective trace, and isarithmic methods. At the regional level, a model was developed for assessing the suitability of various landscape types for woody-biomass production in a 700 square-mile area of southwestern Illinois. At the local level, a landscape simulation model was developed to assist a county park to incorporate fuel-wood production into its overall land-management plan. At the site level, four experimental woodlots were established to assess the feasibility of adapting traditional European silvicultural methods for fuel-wood production in the midwest.

56787 (SESC—8806, pp 12-21) **Guidelines for an optimum economic and environment-conscious cogeneration system using multimodal renewable energies.** Basu, R.N.; Gogger, L.L.; Mansour, N.T. (Univ. of Calgary, Alta.; Solar Engineering Group Ltd., Calgary, Alta.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

The remote rural areas of the world can now find an energy solution for today within the current renewable energy technologies. This may be the only solution in many cases because piped gas or cabled electricity will never reach some of those communites. Villages powered by renewable energy now exist all over the world. Depending on their needs and resources, the modes of renewable energy used in different places are different. This paper deals with the decision process of selecting certain mix of renewable energy systems, in which one or more technologies will be utilized for certain projects depending on the location and profile of energy requirements. Energy modes considered include photovoltaic, wind, small hydro, biogas and/or solar thermal. Design considerations and criteria are listed in a methodical way to assist the potential project developed in deciding the feasibility of the proposed project. Starting from considerations of meteorological and atmospheric databanks and combined resource maps, the designer has to consider diversity and profiles of loads, load factors, future trends, and emerging technologies. Formulae for different energy solutions for a remote community are mentioned, and environmental effects and costs examined. 12 refs., 4 figs., 2 tabs.

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

56788 (DOE/PC/70507—14) MHD [magnetohydrodynamic] channel development: Quarterly report, July 1987-September 1987. (Avco-Everett Research Lab., Everett, MA (USA)). Oct 1987. Contract AC22-84PC70507. 76p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88014787/JAW.

A series of generator experiments was carried out to investigate the functional dependencies of the cathode wall slag layer resegmentation frequency upon fluid and generator characteristics. Variations in gas conductivity, magnetic field intensity, Hall parameter, current density, and electric field intensity were investigated to establish which generator parameter(s) affect the cathode slag shorting patterns. The validity of three proposed models for slag layer resegmentations are tested by comparisons with measured data. The generator test results, showing that the cathode nonuniformity patterns are only a function of the Hall voltage, suggest that the high voltage inter-cathode gaps might be created by axial leakage currents and maintained by arcs. The voltages across the "open" gaps are characteristic inter-electrode arc voltage. The structure and form of sulfur in US coals are reviewed. The effects which the different forms of sulfur in the coal have on the release of sulfur in the MHD combustion environ are described. A survey on the status of corrosion research in MHD and other coal conversion processes is made. Similarities and differences in these conversion processes are noted. Most coal-using systems have encountered corrosion problems related to the sulfur content of the coal. The presence of electrochemical and thermal effects on the MHD generator walls resulted in MHD-specific corrosion problems.

56789 (TU/IAS—UTIAS39) A review of the status of MHD power generation technology including suggestions for a Canadian MHD research program. Stangeby P.C. (Toronto Univ., Ontario (Canada). Inst. for Aerospace Studies). Nov 1974. 162p. (CE—01904). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report presents a review of magnetohydrodynamic power generation and its possibilities for Canada. Information was gathered from a review of the literature, from symposia, and from visits to laboratories. A description of the fundamentals of MHD power generation includes the basics of open and closed cycle systems, liquid metal systems, and power applications. Research needs are outlined and the advantages of MHD generation are summarized; these include high thermal efficiency, ability to handle high power levels, and inherently low pollutant production. An examination of the economics of MHD applications concludes large savings are possible even taking research and development costs into account. The status of world MHD research is reviewed, with a detailed report on Soviet research included in an appendix. The history, status and recommended future of Canada's sole MHD facility is presented. The primary world effort is now focused on equilibrium, combustion MHD with gas (USSR), oil (Japan) or coal (USA). The most appropriate Canadian MHD policy may be to maintain contact with these programs while focusing on special applications which are related to Canada's highest energy priorities of fission power and tar sand technology. In this regard, two special MHD applications are analyzed in detail: a hydrogen combustion MHD system, with off-peak nuclear power plus electrolysis as a hydrogen source; and tar sand processing at high temperatures including MHD applications. An appropriate research program for Canada is outlined, including a shock tube program, a combustion MHD facility, and tar sand studies. 132 refs., 49 figs., 15 tabs.

3005 Fuel Cells

REFER ALSO TO CITATION(S) 56534, 56695

56790 (AD-A—194899/1/XAB) Evaluation, analysis, and documentation support for the 10-kw Signature Suppressed Lightweight Electric Energy Plant (SLEEP). Technical report, April 1987-March 1988. Morsch, B.A.; Main, B.W.; Buckman, A.F.; Feaney, L.M.; Gist, J.Y. (Science Applications International Corp., McLean, VA (USA)). 14 Mar 1988. 417p. (SAIC—88/1572). NTIS, PC A18/MF A01.

The US Army identified the need for a Signature Suppressed, Lightweight Electric Energy Plant (SLEEP) to improve the survivability of forward deployed units. The US Army Belvoir Research, Development and Engineering Center has the responsibility for procuring generators to meet this requirement. This study was to investigate power-generation technology and determine the most-effective technology to meet the SLEEP requirement. The Stirling was identified as the most-promising technology for SLEEP. Commercial systems and improvements to existing systems cannot meet this requirement. Procurement of SLEEP was determined to be well suited for the Army Streamlined Acquisition Program.

56791 (CONF-881010—2) Argonne monolithic solid oxide fuel cell fabrication. McPheeters, C.C.; Dees, D.W.; Dorris, S.E.; Picciolo, J.J. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 4p. NTIS, PC A02/MF A01. Order Number DE89000607/JAW.

From 11. fuel cell seminar: development and application of fuel cells for the 90's; Long Beach, CA, USA (23 Oct 1988).

The Monolithic Solid Oxide Fuel Cell (MSOFC) under development at Argonne National Laboratory is an oxide-ceramic structure in which appropriate electronic and ionic conductors are fabricated in a "honeycomb" shape similar to a block of corrugated paperboard. The electrolyte conducts oxygen ions from the air side to the fuel side and is made from yttria-stabilized zirconia (YSZ). All the other materials are electronic conductors, including the nickel-YSZ anode, the strontium-doped lanthanum manganite cathode, and the doped lanthanum chromite interconnect (bipolar plate). These electronic and ionic conductors are arranged so that they provide short conduction paths to minimize resistive losses. The power density achievable with the MSOFC is expected to be 8 kW/kg or about 4 kW/L because of the small cell size and low resistive loses in the materials. The MSOFC operates in the range of 700 to 1000{degree}C, at which temperatures rapid reform of hydrocarbon fuels is expected within the nickel-YSZ fuel channels. 3 refs., 4 figs.

56792 (CRIEPI—86084) Study of MCFC power plant in the electric utilities. Horiuchi, N. (and others). (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). 1987. Vp. (In Japanese). Central Research Institute of Electric Power Industry, Tokyo, Japan.

This report describes an evaluation of molten carbonate fuel cell (MCFC) plant through a conceptual design, and focuses on the role MCFC would play in a future power generation mix. Several applications of MCFC are possible. Three applications are chosen for the conceptual design. These are: coal-gasified combined cycle power station of 1000 MW for base load use; more efficient several hundreds of MW coal-gasified combined cycle power station replacing the existing LNG fired stations and out-dated oil fired stations for middle load use; and distributed power sources of less than several tens of MW output to be used for peak load shaving. From their performance and economy, the MCFC power stations would be able to substitute for existing thermal power plants, contributing greatly to qualitative as well as quantitative assurance of power supply and to decrease the cost of electricity for electric power utilities in the future.

56793 **(EPRI-AP—6017) System testability and maintenance program for troubleshooting in fuel cell power plants: Final report.** Unkle, C.R.; Himpler, H.P., Jr.; Erickson, E. (Electric Power Research Inst., Palo Alto, CA (USA); International Fuel Cells Corp., South Windsor, CT (USA); Arinc Research Corp., Annapolis, MD (USA)). Sep 1988. 59p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89000570/JAW.

The objective of this study was to develop the basis for a diagnostic tool to expedite utility operator troubleshooting and fault diagnosis in a phosphoric acid fuel cell power plant. ARINC Research Corporation performed a System Testability and Maintenance Program (STAMP) analysis of the dc module for an 11-megawatt (MW) fuel cell power plant designed by International Fuel Cells Corporation (IFC). Results of the analysis for the operating mode indicate that the testability and fault-isolation goals established by IFC can be achieved. Approximately 67% of all component failure modes are uniquely isolatable and fault-isolation to two (or fewer) failure possibilities exceeds 98%. (4 figs., 10 tabs.)

56794 **(TU/ME—8301) Canadian fuel cell development strategy: definition of fuel cell design macro parameters and selection of design concepts, 1981-1982. Final report.** (Toronto Univ., Ontario (Canada). Dept. of Mechanical Engineering). Jan 1983. 107p. (CE—01907). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The report begins with an analysis of the transition away from fossil energy. This analysis is used to identify the market split between "clean" hydrogen and "near clean" hydrogen as well as other transition fuels such as methanol. This is followed by a further development of the principles used to select application niches. New applications, including ships and telecommunications vans, are identified. A comprehensive statement comparing direct railway electrification (catenary or third rail) versus indirect electrification (hydrogen and fuel cells) is presented. Fuel cell selection is addressed by examining some 22 parameters over a range of fuel cell types. This work reconfirms the conclusion of an earlier study recommending a Canadian emphasis on alkaline (KOH) electrolyte cells, but also recommends a second effort on ion exchange membrane fuel cells. Air scrubbing, heat and water management requirements and suggested approaches are reviewed, as is an analysis of bipolar versus monopolar electrode configurations. It is recommended that only bipolar systems be considered for development within Canada. An examination of onboard fuel emphasizes cryogenically liquefied hydrogen with a lesser emphasis on chemically liquefied hydrogen. Performance and economic targets for a Canadian alkaline fuel cell and ion exchange membrane cell are proposed, along with a suggested hierarchy of basic stack module sizes. A rail locomotive performance simulation is outlined, and a point economic analysis using data drawn from this simulation indicates the potential for a major economic advantage for fuel cell locomotives compared to diesel electric locomotives. Finally, several design and manufacturing concepts are recommended. 28 refs., 4 figs., 6 tabs.

56795 **Composite electrode for use in electrochemical cells.** Vanderborgh, N.E.; Huff, J.R.; Leddy, J. US Patent Application 6-109,133. 16 Oct 1987. 28p. Contract W-7405-ENG-36. NTIS, PC A03/MF A01.

A porous composite electrode for use in electrochemical cells. The electrode has a first face and a second face defining a relatively thin section therebetween. The electrode is comprised of an ion conducting material, an electron conducting material, and an electrocatalyst. The volume concentration of the ion conducting material is greatest at the first face and is decreased across the section, while the volume concentration of the electron conducting material is greatest at the second face and decreases across the section of the electrode. Substantially all of the electrocatalyst is positioned within the electrode section in a relatively narrow zone where the rate of electron transport of the electrode is approximately equal to the rate of ion transport of the electrode. 4 figs., 1 tab.

3008 Miscellaneous Converters

56796 **(AD-A—194931/2/XAB) Energy-conversion measurements in laser-sustained argon plasmas for application to rocket propulsion. Final technical report, 18 February 1987-17 February 1988.** Krier, H.; Mazumder, J.; Zerkle, D.K.; Mertogul, A.; Schwartz, S. (Illinois Univ., Urbana (USA). Dept. of Mechanical and Industrial Engineering). 15 Apr 1988. 86p. (UILU-ENG—88-4006). NTIS, PC A05/MF A01.

Laser propulsion is the production of high specific-impulse rocket thrust using a high-power laser as a remote energy source. Specific impulses in excess of 1000 seconds are achievable because propellant temperatures are very high and low-molecular-weight gases can be used. This report focuses on the energy-conversion mechanisms of laser-sustained plasmas in flowing argon. The status of AFOSR-sponsored experiments to determine thermal efficiency and global absorption is detailed. An improved testing facility has allowed plasma operating conditions never before possible. The results indicate that nearly all of the input laser power can be absorbed by a plasma. Plasmas at elevated gas pressure have been tested, and preliminary results are presented. Optimal operating conditions have yet to be determined for the available laser powers and gas pressures. Further experimentation at very high argon gas velocities (> 20 m/s) must be performed in order to completely characterize plasma behavior.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

3201 Buildings

REFER ALSO TO CITATION(S) 56076, 56134, 56430, 56499, 56693, 56749, 56750, 56891, 57452, 57458

56797 **(AC/R—I-428) Greenhouse energy research and demonstration projects in Canada.** Jackson, H.A. (Agriculture Canada, Ottawa, Ontario. Research Branch). Jul 1982. 45p. (CE—01791). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

In order to help the greenhouse industry with the burden of energy costs, the Canadian government has provided funds for research and demonstrations into solutions to reduce the impact that energy costs have on the greenhouse industry. This report provides information on the known recent or ongoing greenhouse energy research, development and demonstration projects in Canada. The greenhouse program encompasses the reduction of heating costs by developing and evaluating waste heat utilization systems and sources, economic solar heating systems, retractable insulation systems, ventilation heat exchangers, optimal temperature regimes that reduce energy consumption without adversely affecting crop productivity, microprocessors for precise environmental control and optimized energy usage. 4 tabs.

56798 **(BNL—41680) A database of PFT ventilation measurements.** D'Ottavio, T.W.; Goodrich, R.W.; Spandau, D.J.; Dietz, R.N. (Brookhaven National Lab., Upton, NY (USA); Versar, Inc., Springfield, VA (USA)). Aug 1988. Contract AC02-76CH00016. 18p. NTIS, PC A03/MF A01. Order Number DE89000259/JAW.

About five years ago, a method for measuring the ventilation flows of a building was developed at Brookhaven National Laboratory (BNL). This method is based on the use of a family of compounds known as perfluorocarbon tracers or PFTs. Since 1982, BNL has measured ventilation in more than 4000 homes, comprising about 100 separate research projects throughout the world. This measurement set is unique in that it is the only set of ventilation measurements that acknowledge and measure the multizone characteristics of residences. Other large measurement sets assume that a home can be treated as a single well-mixed zone. This report describes the creation of a database of approximately half of the PFT ventilation measurements made by BNL over the last five

years. The PFT database is currently available for use on any IBM PC or Apple Macintosh based personal computer system. In addition to its utility in modeling indoor pollutant dispersion, this database may also be useful to those people studying energy conservation, thermal comfort and heating system design in residential buildings. 2 refs.

56799 **(CIM—1988) Energy management control system.** (Canadian Inst. of Mining and Metallurgy, Montreal, Quebec). 1988. 8p. (CONF-8805204—; CE—01927). Petroleum Society of the CIM, 229 - 640 Fifth Ave., S.W., Calgary, Alta., Canada T2P 3G4; $3.50 CAN.

From 90. CIM annual general meeting; Edmonton, Canada (8 May 1988).

The paper describes the reasons, methods and equipment required for the installation of an Energy Management Control System. The principal objectives for installing such a system are to monitor all selected energy loads for cost allocation purposes, and to obtain considerable energy savings through load forecasting, consumption control and the elimination of excessive peak loads. System components are off-the-shelf products, including IBM compatible computers and OPTO input/output devices. QNX, the host operating system, provides the working environment for the computers. The operator interface is user friendly and completely menu driven, with many on-line help screens.

56800 **(DOE/BP—1017) A study of the filling of wall cavities with retrofit wall insulation.** Flores, J.A.; Grill, A.R. (Bonneville Power Administration, Portland, OR (USA)). Aug 1988. 20p. NTIS, PC A03/MF A01. Order Number DE89001545/JAW.

The Pacific Northwest Power Marketing Agency, the Bonneville Power Administration (BPA), conducted a retrofit wall insulation study to determine the effects of various obstructions within a wall cavity, where voids are likely to occur, and preferred filling methods and material types. The insulation test structure was composed of four 8-foot {times} 12-foot walls, and was built using standard construction practices. The inside walls were clear plastic glazing, instead of gypsum board, to enable viewing of the filling process. A total of eight tests were performed: four cellulose, two rockwool, and two fiberglass. One- and two-hole filling methods were observed. All insulations were found to perform in the same basic manner with all experiencing the same problem areas. Common installer problems were empty spaces at the tops of cavities and missed cavities, especially above headers. Wiring and lath and plaster consistently caused reduced insulation densities in cavities. The problems with wiring, lath and plaster, and other features in the wall cavities were avoided with the use of a filler tube. The filler tube also provided a more consistent fill along the length of the entire cavity. 2 figs., 3 tabs.

56801 **(DOE/CH/00016—H1) Buildings and Community Systems: Analysis and technology transfer annual report, 1987.** (Brookhaven National Lab., Upton, NY (USA)). Jul 1988. Contract AC02-76CH00016. 109p. NTIS, PC A06/MF A01. Order Number DE89000417/JAW.

The US Department of Energy (DOE) Office of Buildings and Community Systems (BCS) encourages increased efficiency of energy use in the buildings sector through the conduct of a comprehensive research program, the transfer of research results to industry, and the implementation of DOE's statutory responsibilities in the buildings area. The planning and direction of these activities require the construction and maintenance of database and modeling capability, as well as the conduct of analyses. This report summarizes the results of analytical and technology transfer activities undertaken on behalf of BCS during 1987. It provides historical data on energy consumption patterns, prices, and building characteristics used in BCS's planning processes, documents BCS's detailed projections of energy use by end use and building type (the Disaggregate Projection), and compares this forecast to other forecasts. Summaries of selected recent BCS analyses and technology transfer activities are also provided. 38 refs.

56802 **(DOE/EIA—0246(86)) Characteristics of commercial buildings 1986: Nonresidential buildings energy consumption survey.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 13 Sep 1988. 347p. NTIS, PC A15 - GPO. Order Number DE89000448/JAW.

The data were collected on the 1986 Nonresidential Buildings Energy Consumption Survey (NBECS), Forms EIA-871A-G. EIA conducts this national sample survey of nonresidential buildings and their energy suppliers on a triennial basis. Previous NBECS were conducted in 1979 and in 1983. EIA also conducts energy consumption surveys in the residential, residential transportation, and industrial sectors. The NBECS provides basic statistical information on the consumption of, and expenditures for, energy commercial buildings and their energy-related characteristics. This survey is the only source of national-level data on commercial building characteristics and energy consumption. This report covers the descriptive characteristics of the commercial building stock that affect energy use. A second report will cover energy consumption and expenditures. This report descriptions of commercial buildings at the national and Census region levels in terms of the following characteristics: Building use; Building size; Location; Energy sources; Energy end uses; Conservation features; Heating and cooling equipment and practices; Lighting equipment and practices; Roof and wall construction materials. These data are published to provide meaningful, objective, and accurate energy information for a wide audience including Congress, Federal and State agencies, industry, and the general public. The data presented in this report were collected and published by the EIA to fulfill its responsibilities as specified in the Federal Energy Administration Act of 1974 (Public Law 93-275), as amended.

56803 **(DOE/OR/21548—021) Buildings characterization sampling plan, Weldon Spring Site.** (MK-Ferguson Co., Weldon Spring, MO (USA)). Aug 1988. Contract AC05-86OR21548. 278p. NTIS, PC A13/MF A01. Order Number DE89000694/JAW.

The purpose of the Buildings Sampling Plan is to provide a systematic approach to characterizing radiological, asbestos and chemical contamination in and around the buildings and structures at the Weldon Spring Chemical Plant Site (WSCPS). This sampling plan reviews historical information; identifies data needs; and outlines sampling procedures, quality assurance, data documentation and reporting requirements for the buildings and equipment characterization at the Weldon Spring Site (WSS). The scope of this plan is limited to the buildings, structures, and equipment from the previous operation of the WSCPS. The Buildings Sampling Plan is divided into nine sections: introduction, background, data needs and sampling plan objectives, sampling rationale and procedure, sample analysis, quality assurance, data documentation, reporting requirements, and references. The data needs, sampling rationale and procedures and sample analysis sections of this work plan are subdivided into radiological, asbestos and chemical sections. Because different sampling techniques and analyses will be required for radiological, asbestos and chemical contamination, separate subsections are used. The investigations for each contaminant will be conducted independently. Similar historical and descriptive information is repeated in the subsections, but the perspective and information vary slightly. 24 refs., 5 figs., 14 tabs.

56804 **(DOE/OR/21548—021-App.) Buildings characterization work plan: Weldon Spring Site Remedial Action Project: Appendix.** (MK-Ferguson Co., Weldon Spring, MO (USA)). Apr 1988. Contract AC05-86OR21548. 104p. NTIS, PC A06/MF A01. Order Number DE89000693/JAW.

The following tables and location diagrams are furnished to assist the contractor in identifying and locating known ACM and potential ACM. Each location listed on the tables and shown on the diagrams represents the presence of a major concentration of ACM. Not every location of ACM at the WSCP is listed, two buildings (108 and 403) have not been surveyed, and portions of several buildings were inaccessible. However, the tables reflect all ACM that can be identified at the site prior to the dismantling of buildings.

56805 **(EPRI-EM—6057) Industrial heat pump manual: Technical and applications resource guide for electric utilities: Final report.** Gluckman, R.; McMullan, A.S. (Electric Power Research Inst., Palo Alto, CA (USA); Linnhoff March, Inc., Leesburg, VA (USA)). Oct 1988. 221p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89001084/JAW.

When properly applied, industrial process heat pumps offer process owners the opportunity to achieve significant energy cost and efficiency improvements. This Resource Guide presents the basic technical features of heat pumps and describes the differences between industrial process (or more simply, industrial) heat pumps and commercial units. The current state of the industrial heat pump market is reviewed and analyzed. Industrial heat pumps are not the only energy saving technology available; there are many 'competitors' including passive heat recovery, process modifications, and cogeneration. The way in which the industrial heat pump interacts and competes with these other alternatives is discussed in detail. Pinch Technology is introduced as the best method for finding and assessing all industrial heat and power options. A comprehensive industrial heat pump design methodology is presented. It can be used in industrial plants to identify heat pump opportunities and to ensure good design and operation. This methodology is based on practical experience and will help those interested in promoting and using industrial heat pumps benefit from the last decade of heat pump development. 37 refs., 62 figs., 17 tabs.

56806 **(HAA—7904) Study to examine the technical and economic feasibilty of using aquifers as a chilled water source or storage medium for building air conditioning systems. Vol. 2.** (Hooper and Angus Associates Ltd., Toronto, Ontario (Canada); Hydrology Consultants Ltd., Toronto, Ontario (Canada)). Apr 1979. 86p. (CE—01935). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This paper begins with a summary of aquifers in the various regions of Canada from the perspective of their possible use as a thermal energy storage medium. An introduction is given to water wells, their installation, costs, layout, and operation for use in supplying water to a thermal storage system. The hydraulics of aquifers and the dynamics of thermal storage are discussed. Design parameters, costs, and performance factors are presented for water piping, pumps, distribution systems; disposal of spent cooling water is only mentioned briefly. A review of building cooling and heating systems considers typical cooling loads for Canadian conditions, cooling system capabilities with and without chillers, and the use of heat pumps and other options for cooling the aquifer in the winter. Appendices give costing assumptions and methodology for capital costs, maintenance charges, and life-cycle system costs. 66 refs., 33 figs., 18 tabs.

56807 **(K/CSD/INF—88/21) Calculation of heat flow and temperature fields for building envelopes containing thermal bridges.** Childs, K.W. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 1988. Contract AC05-84OT21400. 71p. (CONF-8810163—1). NTIS, PC A04/MF A01. Order Number DE88017131/JAW.

From Soviet-American symposium on energy conservation research and development; Yalta, USSR (6 Oct 1988).

In a preliminary meeting held at the Princeton University Center for Energy and Environmental Studies on March 14-15, 1988, Soviet and American representatives discussed these problems in some detail. After minor modifications, final problem definitions for six of the thermal bridges were generated. The seventh thermal bridge, originally submitted by the USSR, was withdrawn temporarily to add some further clarification. A common format for presenting the results was agreed upon, and both American and Soviet specialists subsequently solved the six problems. This paper presents the US solutions prepared at ORNL. 52 figs., 6 tabs.

56808 **(LBL—25910) Intensive radon mitigation research: Lessons learned.** Turk, B.H.; Prill, R.J.; Sextro, R.G.; Harrison, J. (Lawrence Berkeley Lab., CA (USA)). Sep 1988. Contract AC03-76SF00098;AI79-83BP12921. 23p. (CONF-8810134—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE89001260/JAW.

From Symposium on radon and radon reduction technology; Denver, CO, USA (17 Oct 1988).

In the past three years, two intensive radon mitigation projects have been conducted on 15 houses in the Pacific Northwest and seven houses in New Jersey. Both studies collected extensive continuous and periodic data on important house and environmental parameters such as indoor and soil gas radon concentrations, indoor and outdoor temperatures, pressure differentials, ventilation rates, and mitigation system performance. Key findings indicate that soil temperatures can substantially influence the pressure difference that drives radon entry; forced air distribution systems can influence both substructure depressurization and the transport of radon to upper floors; air-to-air heat exchangers and basement overpressurization are successful control techniques in limited situations; subsurface ventilation is often an effective control measure; and resistance to flow for subsurface ventilation systems is greatly influenced by the leakiness of the substructure surfaces that are below grade. General guidance for future studies include an emphasis on research into the fundamentals of radon movement and mitigation. 8 refs., 6 figs., 1 tab.

56809 **(MEM—82-144) Computer controlled energy management system, Rolling River School Division #39.** (Manitoba Ministry of Energy and Mines, Winnipeg (Canada)). Aug 1985. 36p. (CE—01945). Manitoba Dept. of Energy and Mines, Legislative Bldg., Rm. 301, Winnipeg, Man., Canada R3C 0V8; $N/C.

A project ot install a remote computer energy management system for four schools was undertaken in west central Manitoba. The energy management system uses a central computer at divisional headquarters in Minnedosa to control the operation of the heating, ventilating and air-conditioning systems at each of the schools. Communication of data and control signals between the central control and remote processing units in the schools is accomplished via the telephone network. Projected energy savings for the system were 35% on the $96,460 project for a 2.7 year simple payback period. Because of difficulties with data transmission from Erickson, this school was omitted from the project pending installation of a suitable alternative method of data transmission. However, the savings from the other three schools has averaged 40% overall, based on energy consumption. The energy-related control techniques include optimized duty cycle and start/stop for unoccupied periods, as well as electrical energy demand control. 9 figs., 2 tabs.

56810 **(MU—1984) Window architectronics. Final report.** MacGowan, D.; Eaton, M.; Epp, E.; Sharp, S. (Manitoba Univ., Winnipeg (Canada)). [1984]. 172p. (CE—01744). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Energy supply questions have caused a renewal of interest in the potential value of building fenestration. This study reports research findings and recommendations covering topics which influence the design of office buildings fenestration. The topics covered are: minimum acceptable window size, discomfort glare (including daylighting influences), and thermal issues. This report provided a method of approaching the design of fenestration in office buildings for architects, interior designers, HVAC engineers, building inspectors, and to those academics charged wtih the education and training of these professionals. 102 refs., 50 figs., 30 tabs.

56811 **(NEI-FI—39) Indirect lighting in office buildings.** Hiltunen, E.; Visuri, P. (Projekti-insinoeoerit Oy, Helsinki (Finland)). (Kauppa-ja Teollisuusministerio, Helsinki (Finland). Energiaosasto). 1987. 59p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754866/JAW.

Indirect lighting is superior to direct lighting in many situations. Even if the lighting level is lower than in wellplanned direct lighing of the same effect, indirect lighting has certain advantages concerning veiling eflections and glare. Recently, small metal halide lamps have begun to be used in indirect lighting systems. They are more efficient than fluorescent lamps in indirect lighting systems. That means that there is sufficient illumination with lower energy consumption. The aesthetic result is also usually better because of smooth shadows. It is impossible to make a general com-

parison between the total costs of indirect and direct lighting because the costs vary considerably in each case. Besides, at this moment, the lumen depreciation and lamp mortality curves of different light sources (for example metal halide lamps) are unknown. It is also difficult to compare two different lighting installations. Only certain specific properties of lighting can be measured. The weight of each property is different depending on the situation. In addition, it must be remembered that the aesthetic aspects are at least as important as the technical aspects. The first modern large-scale indirect lighting system in Finland was installed in the new office building of PI-Consulting Ltd. The system was based on the use of metal halide lamps. The electrical effect of the lighting system met the standard recommendations for direct lighting with fluorescent lamps. Lighting measurements and questionaire results demonstrated the advantages of this form of indirect lighting. Total costs were the same as in direct lighting systems with fluorescent lamps. The initial investment was lower in the indirect system although the maintenance costs were higher.

56812 **(NRC/E—830121) Integrated passive solar design for commercial buildings.** (National Research Council of Canada, Ottawa, Ontario. Div. of Energy). [1983]. 29p. (CONF-8211231—; CE—01899). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

From Integrated passive solar design for commercial buildings workshop; Ottawa, Canada (30 Nov 1982).

A workshop was held in Ottawa to examine current research into the passive solar heating and lighting potential for large commercial buildings. Design of these buildings in order to maximize benefits from passive solar energy has been a recent trend, and an outline of developments in Canada and the USA is presented. Such designs have three main components: solar thermal utilization; cooling and natural ventilation; and daylighting and solar lighting. A number of architectural designs are shown to illustrate the different types of building and wall designs. A passive solar commercial building program in the USA is described, which has involved construction of 28 buildings and their subsequent evaluation. A review is made of daylighting/solar lighting projects, including computerized designing and a solar lighted building in British Columbia using mirrors and light pipes. Energy analysis and design tools, including limited-parameter, analog, graphic, finite-difference, and hybrid methods, are also evaluated. 19 refs., 8 figs., 6 tabs.

56813 **(NRC/E—AIRHEAT1) The economic potential of the air solar wall collector in industrial applications.** (National Research Council of Canada, Ottawa, Ontario. Div. of Energy). Jun 1982. 24p. (CE—01793). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This study was conducted to evaluate the savings which may be realized by adding a solar energy system using air cooled collectors, and by upgrading the thermal resistance in a commercial building. A comparison of auxiliary heating needs was conducted on a building with a range of design variables, in three different Canadian locations, using the BLAST computer program. Results of this study indicated that insulation was the most economically attractive method of improving the performance of an uninsulated building. In a moderately insulated building the solar wall collector was more attractive than further upgrading the thermal resistance. Temperature control strategy and mass of building contents did not have significant impacts on the economics of solar energy systems. Solar preheating of makeup air was economically more attractive than solar space heating. 15 tabs.

56814 **(ORNL—6286) Measurement of volatile organic compounds (VOC) in eight East Tennessee homes.** Gammage, R.B.; Higgins, C.E.; Dreibelbis, W.G.; Guerin, M.R.; Buchanan, M.V.; White, D.A.; Olerich, G.; Hawthrone, A.R. (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 36p. NTIS, PC A03/MF A01. Order Number DE89001343/JAW.

Measurements of volatile organic compounds (VOC) were made inside and outside eight East Tennessee homes. Air samples were collected on Tenax or Tenax-carbonaceous sorbents. Analyses were made by high-resolution gas chromatography flame ionization detection (GCFID) and gas chromatography mass spectroscopy (GCMS) with single-ion monitoring. Analyses were also made directly by injection of small air samples onto a portable gas chromatography photoionization detector (GCPID). The total indoor VOC (C_6 {minus} C_{16}) estimated from the GCFID chromatograms averaged 1.0 mg/m^3 with a range of 0.1-3.7 mg/m^3. The mean outdoor concentration of these total VOC was an order of magnitude less (0.08 mg/m^3). An identification and quantitation were made of some of the individual compounds comprising the total VOC. The 12 target chlorinated VOC that were measured accounted for a mean concentration of 0.064 mg/m^3; methylene chloride at 19 μg/m^3 (6 ppb) and tetrachloroethylene at 22 μg/m^3 (3 ppb) were the two most abundant of these compounds. The sum concentration of toluene and xylene was 0.1 mg/m^3. Other intermediate volatility VOC account for 0.1-0.2 mg/m^3. Gasoline fumes were prevalent indoors, especially in houses with attached garages. Compared to houses without attached garages, the concentration of gasoline vapors and one of its characteristic constituents, 3-methylpentane, was about five-fold higher. The indoor-to-outdoor ratio of gasoline fumes was about 50:1 for houses with attached garages. 15 refs., 6 figs., 10 tabs.

56815 **(ORNL/CON—228/P1) Field test evaluation of conservation retrofits of low-income single-family buildings in Wisconsin: Summary report.** Ternes, M.P.; Boercker, F.D.; McCold, L.N.; Gettings, M.B. (Oak Ridge National Lab., TN (USA)). Jul 1988. Contract AC05-84OR21400. 71p. NTIS, PC A04/MF A01. Order Number DE89001303/JAW.

During the winter of 1985-86, a retrofit field test was performed in 66 occupied, low-income, single-family homes in Madison, Wisconsin. The primary objectives of the field test were to (1) determine the measured energy savings and the relative benefits of a combination of envelope and mechanical equipment retrofits that were selected following a new audit-directed retrofit procedure, (2) determine the energy savings and benefits due to performing infiltration reduction work following a recently developed infiltration reduction procedure, and (3) study general occupant behavior and house thermal characteristics and their possible change following retrofit installation. This report provides an overview of the project and summarizes the findings which will be presented in detail in separate reports. 276 refs., 7 figs, 6 tabs.

56816 **(ORNL/CON—239) Heating energy measurements of single-family houses with attics containing radiant barriers in combustion with R-11 and R-30 ceiling insulation.** Levins, W.P.; Karnitz, M.A. (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 97p. NTIS, PC A06/MF A01. Order Number DE89001304/JAW.

Tests were conducted by Oak Ridge National Laboratory to determine the heating energy performance of two levels of fiberglass-batt attic insulation (R-11 and R-30) in combination with truss and horizontally installed radiant barriers. The tests, a continuation of work started in the summer of 1985, were conducted in three unoccupied ranch-style houses in Karns, Tennessee, during the winter of 1986-87. The measured results of the heating tests showed that a horizontal radiant barrier used with R-11 attic insulation reduced the house heating load by 9.3% compared with R-11 with no radiant barrier, while a truss barrier showed essentially no change in the heating load. Horizontal and truss barriers each reduced the heating load by 3.5% when added to R-30 attic insulation. Moisture condensed on the bottom of the horizontal barrier during cold early morning weather but usually dissipated in the warmer afternoon hours at Karns and left no accumulation in the insulation. Depending on the level of attic insulation, an annual heating and cooling HVAC savings ranging from $5 to $65 is estimated to be attainable when a radiant barrier is installed in the attic at Karns. 8 refs., 64 figs., 18 tabs.

56817 (ORNL/CON—268) Existing building efficiency research, 1987-1988: Research update. MacDonald, J.M.; Karnitz, M.A.; Diamond, R.C.; Ritschard, R.L.; Mixon, W.R.; Sherman, M.H. (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 57p. NTIS, PC A04/MF A01. Order Number DE89001307/JAW.

This Research Update presents the status of the Existing Building Efficiency Research Program of the Office of Buildings and Community Systems of the US Department of Energy for the period 1987-1988. This program covers research on energy efficiency improvements for the residential and commercial buildings in this country. Improving energy efficiency of existing buildings through retrofit measures offers the largest potential for energy savings in the next 10 to 15 years in the United States. The widespread use of retrofits for residential buildings could save 2.6 quadrillion Btu (quads) per year and reduce annual energy costs by $17 billion. Full penetration of energy retrofits into the commercial building stock, for which initial costs are paid back by energy savings in three years or less, could save 2.5 to 3.5 quads per year and $15 to $20 billion per year. The program is working to overcome the technical, financial, and behavioral barriers to the use of building energy retrofits. The current approach is to develop research results and predictive tools that improve confidence in expected savings and allow appropriate efficiency modifications to be selected and installed. Future plans are to assess what the long-term picture for advancing energy technologies will be and what approaches will have to be taken to best meet the needs associated with continuing to improve the energy efficiency of existing buildings. 61 refs., 16 figs., 2 tabs.

56818 (ORNL/M—622) Building Thermal Envelope Systems and Materials (BTESM) and research utilization/technology transfer progress report for DOE Office of Buildings and Community Systems: Monthly progress report. Samples, S.D.; Coleman, G.L. (comps.). (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 80p. NTIS, PC A05/MF A01. Order Number DE89001302/JAW.

The Monthly Report of the Building Thermal Envelope Systems and Materials (BTESM) Program is a monthly update of both in-house ORNL projects and subcontract activities in the research areas of building materials, wall systems, foundations, roofs, building diagnostics, and research utilization and technology transfer. Presentations are not stand-alone paragraphs every month. Their principal values are the short-time lapse between accomplishment and reporting and their evolution over a period of several months.

56819 (PAL—88) Home energy brief, energy efficiency and the old house. (Power (Robert) Architect Ltd., Fredericton, New Brunswick (Canada)). [1988]. 8p. (In English and French). (MICROLOG—88-04165). New Brunswick Dept. of Natural Resources and Energy, P.O. Box 6000, Fredericton, N.B., Canada E3B 5H1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This bulletin is intended for homeowners of older houses who, though wanting an energy efficient house, are determined to maintain the special architectural features of the house. Guidelines are outlined to help the owner choose appropriate measures for energy conservation. Typical heat loss problems associated with old houses are discussed, including air leakage and heat transfer through building materials. Moisture problems are also addressed. In general, old houses tend to be poorly insulated and very susceptible to air leakage, so the guidelines concentrate on remedies for these problems. Caulking and weatherstripping reduce heat loss through air leakage without affecting architectural values of the house, and a number of options are available for insulating walls and roofs, and upgrading windows, that minimize effects on architectural design. 12 refs., 8 figs.

56820 (PB—88-224720/XAB) Joint US-Romanian Seminar on Earthquakes and Energy, September 2-9, 1985. Volume 3. Energy. Aroni, S.; Constantinescu, R. (Architectural Research Centers Consortium, Inc., Washington, DC (USA)). 1987. 442p. NTIS, PC A19/MF A01.

See also Volume 1, PB—88-224647; Library of Congress catalog card No. 87-70464.

The Joint U.S.-Romanian Seminar on Earthquakes and Energy was held September 2-9, 1985, at the Romanian Building Research Institute (INCERC) in Bucharest. During that week over 70 researchers from Romania and the United States met in intense and vivid discussions on topics of building research, with the focus on earthquakes and energy conservation. This volume contains the 29 papers on topics of energy. Those dealing with energy conservation included solar passive and active systems, retrofitting, daylight applications, total building performance, and problems of energy conservation at an urban scale.

56821 (PB—88-229547/XAB) Preliminary experiments in a research house to investigate contaminant migration in indoor air. Final report. Koontz, M.D.; Rector, H.E.; Fortmann, R.C.; Nagda, N.L. (GEOMET Technologies, Inc., Germantown, MD (USA)). Jun 1988. 92p. (GEOMET-IE—1882). NTIS, PC A05/MF A01.

Controlled experiments were performed in an unoccupied research house to provide (1) a detailed characterization of the migration patterns of contaminants released indoors from consumer products and (2) a basis for assessment of the exposure implications of contaminant migration and the accuracy of currently used exposure-assessment models. To enable relatively detailed spatial and temporal monitoring with readily available instrumentation, carbon monoxide (CO) was chosen as a surrogate contaminant for the investigation. Within an hour after the release was terminated, concentrations approached spatial uniformity even though a central air-circulation fan that would have promoted contaminant migration was turned off as part of the experimental design. A single-chamber indoor air-quality model provided closer approximation of passive than active exposures. Use of a two-chamber model resulted in better estimates of each type of exposure.

56822 (PB—88-230024/XAB) Nano-composite desiccation materials. Annual report, March 1987-February 1988. Komarneni, S.; Roy, R. (Pennsylvania State Univ., University Park (USA). Materials Research Lab.). Mar 1988. 58p. NTIS, PC A04/MF A01.

The overall objective of the research is to tailor-make novel desiccant materials consisting of different nano-composite materials using clays, gels, zeolites, and their mixtures and to determine and understand their water-sorption properties for cooling-system applications. Natural zeolites exhibited, as expected, extreme Type I isotherms for water sorption with upward deviation of isotherm at higher relative pressures which is attributed to the presence of impurities and less-than-perfect crystallinity of these zeolites. A few of the naturally occurring zeolites were identified to be suitable for modification by a proprietary process. Synthetic zeolites exchanged with various alkali metal cations such as Li^+, Na^+, K^+, Rb^+ and Cs^+ also produced extreme Type I isotherms. The authors have developed a proprietary cation-exchange process which resulted in a reduction in the polarity of zeolite structure and yielded a desired isotherm shape. A commercially available silica gel was procured for making nanocomposites by introducing second phases in the gel pores. Attempts to load the pores of silica gel to render it microporous by precipitating $BaSO_4$, $AlPO_4$ and AgCl at ambient conditions are underway.

56823 (PNL—6647) Current cost and performance requirements for residential cool storage systems. Brown, D.R.; Spanner, G.E. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1988. Contract AC06-76RL01830. 73p. NTIS, PC A04/MF A01. Order Number DE89000420/JAW.

This study defines the current cost and performance requirements for residential cool storage technologies based on the characteristics of conventional air conditioning equipment and residential time-of-day (TOD) rate structures existing during the 1986--1987 time frame. Currently, rate structures are changing rapidly. Given the volatility of rate structures, the establishment of cost goal is challenging. The goals presented in this study are based on the utility rate structure as of 1986. This study serves to define residential cool storage cost and performance requirements in the current economic environment as well as the many issues affecting the requirements for residential cool storage systems both now and in the future. The same methodology can be employed to establish long-

run goals once future rate structures are adequately defined. 12 refs., 6 figs., 18 tabs.

56824 **(PNL-SA—15543) Comparison of the performance and energy savings potential of heat pump, solar, and conventional water heaters in the Pacific northwest.** Bamberger, J.A.; Cody, B.; Hanlen, R.C.; Zimmerman, P.W. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1988. Contract AC06-76RL01830. 15p. (CONF-880814—12). NTIS, PC A03/MF A01. Order Number DE88015939/JAW.

From Summer study on energy efficiency in buildings; Pacific Grove, CA, USA (28 Aug 1988).

Electricity consumed by water heaters is a significant fraction (20 to 30%) of residential annual electricity consumption. To obtain estimates of water heating energy savings potential in the Pacific Northwest, the Bonneville Power Administration designed a study to compare electrical consumption of conventional resistance type water heaters to electrical consumption of solar and heat pump water heaters. The basis of comparison is electrical consumption and demographic data collected by Bonneville Power Administration and the Oregon Department of Energy (ODOE). The energy savings potential for the technologies is evaluated and categorized by site characteristics, climate or solar zone, family size, and technology type. The data are adjusted for occupancy level and site descriptor variables (covariates), including age and income level of occupants, the presence of dishwashers and flow restrictors. The estimated annual electrical usage of heat pump and solar systems is 21 to 62% lower than conventional systems, with solar systems saving more that pump systems. With the cost of electricity at $0.04/kWh, the expected savings for heat pump water heaters compared to the conventional water heaters is $33 per year. The expected savings for solar water heaters compared to conventional water heaters is about $50 per year and is dependent upon the solar zone. 1 ref., 10 tabs.

56825 **(PNL-SA—15591) Evaluation of DOE's partners in low-income residential retrofit program summary paper.** Calaway, J.W.; Lee, A.D. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 4p. (CONF-8809142—1). NTIS, PC A02/MF A01. Order Number DE88015926/JAW.

From American Council for an Energy Efficient Economy conference; Pacific Grove, CA, USA (3 Sep 1988).

In July 1986, the US Department of Energy (DOE) awarded competitive grants of $100,000 each to five states to develop and implement resource leveraging programs using public-private partnerships to accomplish low-income residential energy retrofits. These programs have been monitored and analyzed through a concurrent process evaluation conducted by the Pacific Northwest Laboratory (PNL) under contract to DOE. This paper presents information about the conduct of the evaluation and its findings.

56826 **(QU—8305) Evaluation of the Energy Cost Indicator demonstration program: a report on Canadian and United States field experiments. Vol. 3.** Mauser, G.A.; Hutton, B.R.; Filiatrault, P. (Quebec Univ., Montreal (Canada); Simon Fraser Univ., Burnaby, British Columbia (Canada); Denver Univ., CO (USA)). May 1983. 68p. (In French). (CE—01932). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This paper reports on a series of year-long field experiments in Quebec investigating the effectiveness of a prototype feedback device in reducing household energy use. The prototype tested in these experiments is called an Energy Cost Indicator (ECI). The ECI can monitor both gas and electricity consumption (but not fuel oil) and then displays total costs incurred in a series of easy-to-read LED displays. The research design was a pretest-posttest, control group design, in that household energy consumption was measured both before and after experimental intervention. In addition, respondents were also interviewed at the end of the study. The field experiment was restricted to all-electric homes in two distinct Montreal suburban areas. Households with ECI used 4.2% less energy than households in other conditions. No striking differences were observed across experimental conditions in attitudes towards energy conservation, knowledge of energy use or in household characteristics. Most respondents with ECI judged the ECI and the accompanying explanatory material to be useful. Approximately half of households said that they would pay for the ECI they then had. The ECI was seen as helping respondents using primarily by motivating them to conserve because they could see the dollars mounting up on the display. Respondents strongly preferred renting the ECI to purchasing it. Strong support was shown for government subsidization of the ECI. 18 tabs.

56827 **(SBI-R—192) Prefabricated components for external, additional insulation of gable walls.** Noerregaard, M.; Stampe, M.; Kjaer, A. (Statens Byggeforskningsinstitut, Hoersholm (Denmark)). 1988. 23p. (In Danish). Statens Byggeforskningsinstitut, DK-2970 Hoersholm.

EFP-84.

The present report describes a project the purpose of which was to examine the possibilities of providing additional, external insulation to gable walls of older buildings by means of prefabricated insulating panels. The project is a continuation of a previous project concerned with additional, external insulation of walls and described in SBI-Report 132: Additional, external insulation of a block of flats. The conclusion from the previous project was that a traditional working process with much labour on the building site made the approach uneconomic. With this background the present project was initiated with the purpose of demonstrating that prefabrication of insulating components would give technically good solutions at a more competitive price. In contrast to the previous project, only solutions for gable walls were considered in this project. In this way complicated fittings around windows were avoided. In the present report two different types of components are described. For demonstration purposes they have both been mounted on two gable walls in Central Copenhagen. For one of the gables fairly small components, 1,8 m x 0,8 m, were chosen. They were made of glass fiber, reinforced concrete shells with a 100 mm mineral wool insulation. For the other project large components, 3,0 m x 3,0 m, were chosen. They were made of coated steel panels fixed to steel profiles and with a 125 mm mineral wool insulation. The fibre-reinforced concrete components were mounted by hand from a scafford whereas the larger steel components were mounted by means of building lifts. (EG).

56828 (SESC—8806, pp 316-321) **Ventilation: parameters, problems and solutions.** Khandekar, S.; Tamblyn, T. (Engineering Interface Limited, North York, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

Energy conscious building designers adopted methods of reducing energy usage by making tighter buildings, reducing amounts of outdoor air and reducing air motion in building space. At the same time introduction of newer building materials by manufacturers has lead to problems with indoor air quality. The role of a building designer and owner/manager with respect to healthy building maintenance is reviewed. The control and maintenance of optimum indoor environment rests mainly on the ventilation systems, their control, maintenance and adequate design. ASHRAE has conducted rearch and developed standards for the minimum ventilation requirements since 1930 and has continually updated these requirements depending on the research results. Typical building ventilation systems, one with constant volume and variable temperature and the other with variable volume and constant temperature are reviewed. The minimum ventilation rates and measurement of ventilation rates are presented. 4 figs.

56829 (SESC—8806, pp 311-315) **Field performance of a heat recovery ventilator.** Howell, D.G.D.; Mayhew, W.J.; Hamlin, T.L. (Howell Mayhew Engineering, Inc., Edmonton, Alta.; Canadian Home Builders' Association, Ottawa, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

The temperatures in which heat recovery ventilators (HRV) are operated in the field are often lower than the conditions under

which they are tested in a laboratory. In this study, data was collected on the performance of an HRV using a computer-based monitoring system in an occupied home during a recent Edmonton winter. The results show that although the performance of the core of the HRV was representative of that recorded in the laboratory, other conditions which are only found in the field such as long and poorly insulated cold-side ducts contributed to a greatly decreased efficiency of the installed system. The study also brought up several questions on the capabilities of the defrosting mechanism and the effect of other appliances on HRV operation. 4 figs., 2 tabs.

56830 (SESC—8806, pp 304-308) **Superglazing, U-value = 0.9.** Littler, J.; Robinson, P. (Polytechnic of Central London, UK). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

The glazing systems tested in this paper are variations on the superglazing system used in the "Courtyard" passive solar house design. The superglazing consists of a sealed triple glazed unit with two Interpane IPLUS Neutral soft low-e coatings, and two 12 mm cavities filled with argon, a low-e louvered blind, and a fourth, protective, outer sash. All components are housed in a standard Nor-Dan timber frame. Four experimental methods have been compared for the measurement of window U-values, and two for shading coefficients. These results have been set against three computerized calculation models (VISION, WINDOW 2.0 and MULTB). Experimental tests in the USA and England agree well ith the models and all indicate U-values of 1.0 +/- 0.1 W/m/sup 2//K, approximately equivalent to US R6. Integral low-e louvers are found useful by occupants but not effective at improving U-values. 11 refs., 1 fig., 1 tab.

56831 (SESC—8806, pp 299-303) **Calculating window U-values including frame effects.** Carpenter, S.; McGowan, A. (Enermodal Engineering Ltd., Waterloo, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

This paper presents a methodology for calculating total window heat loss including the effects of edge-seal and frame. The methodology consists in treating a window as having three sections: center glazing, edge glazing and frame. A computer program has been developed from this methodology, and is designed for use by window designers and manufacturers. Sample output plots and calculations for different kinds of frames are included. 6 refs., 3 figs., 2 tabs.

56832 (SESC—8806, pp 294-298) **One year with a super window.** Dale, J.D.; Ackerman, M.Y. (Univ. of Alberta, Edmonton). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

Evaluation of the perfomance of a high technology window under in-situ conditions in an Alberta climate was undertaken. The window, a commercial unit, utilizes dual glazing plus dual suspended films coated to reduce radiative losses. The window unit was designed to reduce night time heat losses as well as day time radiation gains in order to reduce both heating and air conditioning loads. Results indicate that the window, while appearing to decrease night time losses compared to the conventional double glazed unit, also strongly reduced daytime radiation gains. The reduced day time gain resulted in a net increase in the test module's energy usage compared to the use of night window insulation of RSI 1.76. Overheating in the test house was all but eliminated as solar radiation transmission was reduced from the usual 60-65% to approximately 30% for angles of incidence ranging between 20 and 45 degrees. 2 refs., 6 figs., 2 tabs.

56833 (SESC—8806, pp 286-293) **Laminar air flow super window.** Yuill, G.K.; Gin, K. (G.K. Yuill & Associates Ltd., Winnipeg, Man.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

Recently, building research efforts have been directed at developing energy efficient windows whose combined optical/thermal performance is expected to be substantially improved over conventional windows. One approach to this concept is called the Laminar Air Flow Super Window (LFSW), which draws outside air between the panes. This air recovers the heat that would normally be lost through the window by conduction. The preheated air can be used to provide preheated ventilation air in the building. A thermal boundary layer will develop in the laminar air flow between the window panes. If the pane spacing and the air flow rate are such that the air flow remains laminar, and the thermal boundary layer does not reach the outer glazing, then there will be no conductive heat loss through the window. In this project, numerical models were used to determine the heat absorbed by the air flow between the glazings. A modified version of the VISION glazing simulation computer program was used to determine the overall thermal losses of the window due to convection. With these simulation techniques, a set of parameters defining the window dimensions and air flow velocity was determined, such that the window heat loss was minimized and the air flow was laminar and hydrodynamically stable. A window with three glazings, one of which had a low emissivity coating, achieved a nighttime equivalent R-value of R14 in the simulations. This is a substantial saving over the typical R3-value of conventional triple glazed windows. A prototype of the LAFSW was constructed and installed in a house to find whether there were any unforeseen practical difficulties with the window. No practical difficulties were encountered. 7 refs., 2 figs., 3 tabs.

56834 (SESC—8806, pp 281-285) **Screen graphics software for the vision glazing system analysis program.** Baker, J.A.; Sullivan, E.F.; Wright, J.L. (Univ. of Waterloo, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

VISION is a computer program that performs a 2-band (solar and thermal), one-dimensional, thermal analysis of a wide variety of glazing systems. This paper outlines modifications that permit VISION to output results graphically on the computer screen. The screen graphics software augments the program's graphical plotter output. The user can examine the cross-section of a glazing system showing the position and thickness of each glazing as well as the presence of optical coatings. The glazing system geometry can be checked to see if the system was properly described at the time of input. The indoor/outdoor temperature profile is superimposed on the glazing system so that condensation problems at the cold indoor glazing or overheating problems caused by absorbed solar radiation can be pinpointed. A printscreen utility allows the user to reproduce graphical output using a graphics printer. 9 refs., 2 figs.

56835 (SESC—8806, pp 260-263) **Heat dephasing and heat recovery ventilation combine system.** Ouellet, C. (Institut G.R.A.C.E., Montreal, Que.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

This paper starts with a discussion of the bases for the acceptance of certain solar architectural design principles among Canadians. It is felt that current practice of building with low-thermal-mass techniques and the Canadian preference for low indoor temperature variation, combined with Canadian climatic factors, mean that such features as Trombe walls, shutters, and thermal storage with high thermal mass are not going to find acceptance. Important features are felt to have to do with proper orientation of rooms according to the sun, proper sizing of windows, and temperature con-

trol by means of an automatically controlled air displacing unit. Some design features of houses incorporating these principles are described. One system uses extraction of hot air from the highest point of the house and blowing it through ducts in the cellar floor slab. A modification of this system adds on a ventilation unit that exhausts a variable portion of the air, after it has run through the floor slab, out of the house. As a heat recovery ventilation system, this is not felt to be as efficient as some prepackaged heat exchanger models, but is of lower price and has low maintainence cost. 2 figs.

56836 (SESC—8806, pp 255-259) **Radiant panel heating revisited.** Dale, J.D.; Ackerman, M.Y. (Univ. of Alberta, Edmonton). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

Radiant floor heating systems which use a uniformly heated slab have been historically shown to be suited for heating large areas in well insulated buildings where the heating load does not change rapidly with time. This paper presents a brief overview of previous research in the area as well as preliminary results of a study into the performance of a modified panel system in an Alberta climate. Preliminary results have shown that in a passive structure the wide variation in day/night heating load and solar gains make the proper design of both system and controls of utmost importance if an acceptable comfort level is to be achieved. Simple on/off control of individual zones appears to be inadequate and leading to severe overheat in zones with south facing windows. 10 refs., 5 figs.

56837 (SESC—8806, pp 193-198) **Performance of a C/I exhaust air heat recovery heat pump.** Carpenter, S.; Kokko, J. (Enermodal Engineering Ltd., Waterloo, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

This paper describes the performance of a novel heat pump that extracts heat from room temperature ventilation air and heats process or domestic water. The pump is a pre-packaged unit that can be mounted indoors or outdoors, and can operate on air flows of 700-1400 l/s at air temperatures between 15 and 40 degrees C. Field test units were installed in two Ontario sites in recreational buildings. The two systems have operated reliably, and average daily coefficients of performance have been found to be 3.7 and 5.1. Based on performance to date, the annual energy savings at one site are estimated to be 42,300 kWh (the unit supplying 76% of the hot water heating load) and at the other site 110,600 kWh (the unit supplying 36% of the hot water heating load). Energy savings are a strong function of the size of the water load, and system performance is better with high heat pump water flow rates. 4 figs.

56838 (SESC—8806, pp 188-192) **Minimizing indoor pool energy consumption through proper control.** Carpenter, S.; Baker J. (Enermodal Engineering Ltd., Waterloo, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

The purpose of this study is to determine how energy can be saved in indoor swimming pools through proper control of pool make-up air flow and temperature. The two most common ventilation systems, using constant make-up air and humidity controlled make-up air, are examined. The optimum control setpoints for each system are determined, along with the energy savings possible by converting a constant-flow system to a humidity-controlled system. A swimming pool in Ontario was chosen as a case study. Energy consumption was calculated, taking into account three components of the heating requirement: pool water, pool ventilation air, and pool shell losses. The WATSUN computer model was used for evaluation. Results show that in the constant-flow system, total heating load decreased as the temperature increased. The humidity control system heating load decreased with increased pool air temperature. At a pool air temperature of three degrees above the water temperature, the humidity control system has a heating load of 360 GJ lower than the constant flow system, representing an annual savings of $3,000-6,000, depending on heating fuel type. It was also shown that with a pool air temperature six degrees above the water temperature, it may be possible to eliminate the pool water heater. 1 ref., 3 figs.

56839 (SESC—8806, pp 177-182) **Electrical energy technology in commercial/institutional buildings in Ontario.** Markowitz, T.; Peters, R.; Tamblyn, T. (Ontario Ministry of Energy, Toronto; Marbek Resource Consultants Ltd., Ottawa, Ont.; Engineering Interface Ltd., Willowdale, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

The paper summarizes the results of a study carried out for the Ontario Ministry of Energy, completed in 1988. It describes the opportunities to reduce electical energy consumption and peak power demand in commercial and instituional buildings, in Ontario, through the use of new technology. The study identifies and quantifies the major uses of electrical energy in Ontario's commercial and institutional buildings. Eighteen promising new technologies are examined for their potential for reduction in electrical energy consumption and power demand. These technologies involve cooling, lighting, motors, and total electrical use. A concise technology profile for each new technology summarizes key information. The six best technologies, in terms of potential energy and demand savings, are the following: screw-in fluorescent lights, energy management control systems, eneregy-efficient fluorescent lights, high efficiency light fixtures, variable speed drives, and air balancing. Office buildings and retail stores are the types of buildings with the highest potential for electrical efficiency improvements. A program of intiatives is recommended to encourage the adoption of energy-efficient technology with emphasis on buildings. 1 ref., 3 figs., 2 tabs.

56840 (SESC—8806, pp 138-142) **Increased solar energy utilization in greenhouses, using leaf temperature and thermal curtains to reduce winter heat demand.** Brundrett, E. (Univ. of Waterloo, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

This paper examines the influence of thermal curtains upon the leaf temperature of the crop canopy in a greenhouse. Experimental evidence and theoretical extension of the data show that the installation of thick insulating curtains leads to dramatic increases in the leaf temperature of the crop canopy during winter nights. The paper then examines the multiple benefits of thermal curtains to solar energy utilization in greenhouses. When curtains are deployed, the increase in leaf temperature permits reduction of greenhouse air temperature , resulting in less loss through the cladding and by air infiltration. This savings in addition to that created by the added thermal resistance of the curtain. Passive and active solar storage masses can store and release a significantly greater amount of energy when the greenhouse nighttime air temperature is reduced, since a greater temperature differential occurs between the daytime storage and nighttime release temperatures. 8 refs., 5 figs., 1 tab.

56841 (SESC—8806, pp 48-52) **Lighting power conservation in offices and classrooms.** Stoyke, E. (Edmonton Public School Board, Alta.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

Very little seems to be known about optimum lighting conditions for classrooms and offices. For this reason a large savings potential in the area of lighting power is often neglected. The lighting designer tends to consult the local building code. In Alberta the building code happens to call fo 800 lux for classrooms. Alberta Education, however, recommends 500 lux, and an environmentally

conscious country like Sweden decrees 200 lux as sufficient. Starting out from these wildly differing recommendations, this paper attempts to shed some light on the biological findings that will help to select the proper lighting level and provide some technical information on choosing economical solutions to achieve low power consumption. At Edmonton public schools, reductions of lighting power consumption tended to be around 30-50% in classrooms and offices. It is felt that an information campaign that makes users aware of the benefits of lower lighting levels is the most important step prior to delamping or other reduction of lighting levels. 7 refs., 1 fig., 1 tab.

56842 (SESC—8806, pp 42-47) **A preliminary assessment of daylighting in Calgary's Olympic Oval.** Love, J.A.; Edmunds, D.; Navvab, M. (Univ. of Calgary, Alta.; Graham McCourt Architects, Calgary, Alta.; Univ. of Michigan, Ann Arbour). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

The Olympic Oval in Calgary is a multi-use recreational facility, although it is best known as the home of the largest indoor speed skating oval in the world. One of the largest and deepest buildings in which daylight design was a primary consideration, it spans 86 metres at its narrowest point. A perimeter glazing system with interior and exterior light shelves reflects light into the core of the building. A system of motorized blinds working in conjunction with the light shelves provides control over direct sunlight. The rationale for the use of daylighting, the integration of structural, enclosure and lighting systems, and the daylighting design methods are discussed. Aspects of the design affected by cold climate conditions are reviewed. While post-construction monitoring has been limited due to preparations for and security related to the 1988 Olympic Winter Games, some measurements of daylight levels were made near completion of the building during the summer of 1987. These are reviewed and compared with pre-construction estimates obtained through model studies. 6 refs., 8 figs.

56843 (SESC—8806, pp 37-41) **Potential savings through the use of daylighting strategies.** Jones, L.; Gray, D.B. (Leslie Jones & Assoc., Inc., Ottawa, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

The objective of the work reported in this paper was to investigate the potential energy savings associated with daylighting strategies in office buildings, specifically with the reduction and/or elimination of electric lighting during those periods when daylight can provide adequate illumination. The study was carried out using daylighting and thermal modelling techniques using the DOE 2.1B energy analysis program. Accuracy of the daylighting simulation was checked by comparing measured and calculated results for several rooms in an Ontario office building. Simulations were then carried out for buildings with no daylighting strategies; these were then remodelled using three different light switching strategies. Some general observations made from the results are as follows. Similar results were seen for otherwise identical rooms that had either unobstructed or partially obstructed views. The greatest potential energy savings occur in rooms with large windows, shades raised and views that are not fully obstructed. Significant savings are achieved in rooms with either small or large windows, shades raised and fully obstructed views. Little or no savings were calculated for rooms with small windows and shades lowered; and for rooms with large windows, shades lowered and fully obstructed views. For those rooms with greatest savings, manual on/off control by good occupants (those who switched off lights when daylight level exceeded 500 lux) achieved 80-90% of the savings realized for an automatic step control. Those rooms realizing only small savings for an automatic step control system will typically have no savings for a manual on/off system. 11 refs., 2 figs.

56844 (SESC—8806, pp 25-31) **Daylighting in large office buildings: energy, economic parameters and opportunities.** Johnson, C.A.; Besant, R.W.; Schoenau, G.J. (Univ. of Saskatchewan, Saskatoon). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

It has been found that daylighting of office buildings can be cost effective in many regions of the USA, especially in the south. In this paper, recent literature on daylighting is reviewed; computer simulation packages for daylighting analysis are compared; life-cycle costs are analysed for a large office building in Saskatoon, Saskatchewan, with and without daylighting, and, finally, the opportunities for daylighting in new office buildings in Canada are estimated. It is shown that daylighting of new office buildings in a cold climate like Canada may lead to significantly lower operating and life-cycle costs and to high levels of occupant satisfaction. 20 refs., 2 figs., 1 tab.

56845 (STF—11A87067) **Heat pumps in occupational buildings.** Eggen, G. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Nov 1987. 16p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754891/JAW.

The report discusses the cost and usefulness of heat pump installations for the heating/cooling and water heating purposes in well insulated occupational buildings. The installations of these kinds are to be well-suited for hospitals/nursing homes, gymnasiums/swimming pools, and hotels. The high-level demands of long-lasting and continuous operation for such types of installations, make them beneficial. Examples are given. 10 drawings, 7 tables.

56846 (STF—11A87074) **Auxiliary heat for heat pumps.** Stene, J. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Dec 1987. 37p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754892/JAW.

The report gives a technical/economical evaluation of gas-fuelled boilers designed for the peak load/auxiliary heat supply in a heat pump system. The evaluation shows that the boilers mentioned can be a competitive alternative compared to the oil-fuelled and electric powered boilers of today. In addition, a combined boiler/electric-based energy system seems to be a very flexible and almost non-polluting system. 9 drawings, 6 tables.

56847 (STF—15A87041) **Royal-DEBAC program documentation.** Harsem, T.T. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Aug 1987. 251p. (In Norwegian). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88754894/JAW.

The report describes the development of the computer program Royal-DEBAC. The structured programming is described, and each of the routines are documented with the function and parameter flow. The report is addressed mainly to users wanting to study details of the mode of operation or to make changes or extensions to the program. The report ought to be read together with the Royal- DEBAC Guidance for users, STF--15A86065. 2 drawings.

56848 (TKK-KO/LVI—C30) **Indoor air research in office buildings.** Majanen, A. (Helsinki Univ. of Technology, Otaniemi (Finland). Lab. of Heating, Ventilation and Air Conditioning). (Helsinki Univ. of Technology, Otaniemi (Finland)). 1987. 119p. (In Finnish). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88754915/JAW.

The aim of this project was to study the indoor air quality in the office building and the impact the air conditioning system had on the air quality. In the course of the study the following indoor climate parameters were measured: air temperature, mean radiant temperature, operative temperature, relative humidity, air velocity, supply and exhaust airflows, air exchange rates (measured by means of tracer gas), carbon dioxide and particles concentrations, the concentrations of the bioaerosols, the concentrations of positive and negative small air ions, amount of organic gases, radon concentra-

tion, noise level and electric and magnetic fields. The measurements were carried out by six research institutes.

56849 **Rotary magnetic heat pump.** Kirol, L.D. US Patent Application 6-013,518. 11 Feb 1987. 26p. Contract AC07-76ID01570. NTIS, PC A03/MF A01.

A rotary magnetic heat pump constructed without flow seals or segmented rotor accomplishes recuperation and regeneration by using split flow paths. Heat exchange fluid pumped through heat exchangers and returned to the heat pump splits into two flow components: one flowing counter to the rotor rotation and one flowing with the rotation. 5 figs.

3202 Transportation

REFER ALSO TO CITATION(S) 58322

56850 **(EMR/TE—TE-82-3) Motor vehicle characteristics data base documentation.** (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Transportation Energy Div.). Jul 1982. 17p. (CE—01795). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

In order to follow the progress of energy use in the Canadian transportation sector and to act as a basis for future policy and program development, it was necessary to establish a comprehensive data base covering the sales, efficiency, and physical attributes of motor vehicles. This report documents a data base which provides this information for new motor vehicles sold in Canada since the 1975 model year. Known as the Vehicle Characteristics Data base, it includes physical attributes (engine type and displacement, inertia and curb weight, fuel type, interior volume index, fuel consumption) for each model of vehicle sold in Canada. For each model year, sales of these vehicles are provided by province and major city nation-wide. Data may be aggregated and sales weighted by a few simple commands. Data summary in the form of tables, graphs and histograms is also available. 4 figs.

56851 **(MU—1987) Determination of traffic platoon dispersion as a function of saturation rate.** Lefebvre, S. (Montreal Univ., Quebec (Canada). Centre de Recherches Mathematiques). Aug 1987. 129p. (In French). (MICROLOG—88-00544). Centre de recherche sur les transports, Universite de Montreal, CP 6128, Succursale A, Montreal, P.Q., Canada H3C 3J7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, O.

The TRANSYT simulation and optimization program is probably the most widely used traffic model in the world. However, its results are based upon the ability of Robertson's dispersion model to predict platoon dispersion. In spite of the studies on its calibration, the dispersion factor of the model is still determined in a qualitative manner. The choice proposed in the program is based on three friction levels describing the external conditions of the traffic flow. Some of these studies reveal problems concerning the qualitative relationship. Following the analysis of these observations, the external friction can explain only part of the dispersion. Another concept which is the internal friction of a platoon must be considered. Thus, the purpose of this study is to determine the relationship between the dispersion factor of Robertson's model and the volume which characterizes the internal friction concept on arterial roads with low external friction. Two experiments and two simulations on a microscopic model were conducted in order to verify the internal friction hypothesis. The analysis reveals that the dispersion increases with increasing volume up to a maximum value. Still increasing the volume, the dispersion decreases in an opposite way to the actual dispersion concept. 63 refs., 28 figs., 25 tabs.

56852 **(ORNL—6437) Modeling operating weight and axle weight distributions for highway vehicles.** Greene, D.L.; Liang, J.C. (Oak Ridge National Lab., TN (USA)). Jul 1988. Contract AC05-84OR21400. 151p. NTIS, PC A08/MF A01. Order Number DE89001347/JAW.

The estimation of highway cost responsibility requires detailed information on vehicle operating weights and axle weights by type of vehicle. Typically, 10--20 vehicle types must be cross-classified by 10--20 registered weight classes and again by 20 or more operating weight categories, resulting in 100--400 relative frequencies to be determined for each vehicle type. For each of these, gross operating weight must be distributed to each axle or axle unit. Given the rarity of many of the heaviest vehicle types, direct estimation of these frequencies and axle weights from traffic classification count statistics and truck weight data may exceed the reliability of even the largest (e.g., 250,000 record) data sources. An alternative is to estimate statistical models of operating weight distributions as functions of registered weight, and models of axle weight shares as functions of operating weight. This paper describes the estimation of such functions using the multinomial logit model (a log-linear model) and the implementation of the modeling framework as a PC-based FORTRAN program. Areas for further research include the addition of highway class and region as explanatory variables in operating weight distribution models, and the development of theory for including registration costs and costs of operating overweight in the modeling framework. 14 refs., 45 figs., 5 tabs.

56853 **(PB—88-229430/XAB) Pavement performance equations. Final report.** Mahoney, J.P.; Kay, R.K.; Jackson, N.C. (Washington Univ., Seattle (USA). Dept. of Civil Engineering). Mar 1988. 30p. NTIS, PC A03/MF A01.

The WSDOT PMS data base was used to develop regression equations for three pavement surface types: bituminous surface treatments, asphalt concrete, and portland-cement concrete. The primary regression equations developed were to predict Pavement Condition Rating (PCR) which is a measure of the pavement surface distress (ranges from 100 (no distress) to below 0 (extensive distress)). Overall, the equations fit the data rather well given the expected variation of pavement performance information. The relative effects of age (time since construction or reconstruction) were illustrated for the three surface types.

56854 **(PB—88-232616/XAB) Guidelines for using recycled tire carcasses in highway maintenance. Final report.** Williams, J.A.; Weaver, D.C. (California State Dept. of Transportation, Sacramento (USA). Office of Transportation Lab.). May 1987. 143p. NTIS, PC A07/MF A01.

This report presents an investigation into the use of discarded tires for use as shoulder reinforcement and channel slope protection in areas where serious erosion has occurred. It also investigated the use of discarded tires for windbreaks for the temporary control of blowing sand. Guidelines for shoulder reinforcement and channel slope protection are included in the report. Three separate projects were initiated to explore the use of discarded tires in highway maintenance. The results of the research have indicated the construction of shoulder reinforcement and channel slope protection with discarded tires provide an immediate and economical solution for minor contracts and projects initiated by maintenance personnel. The use of discarded tires for windbreaks provided temporary protection for the trees and the roadway. It also provided for the disposal of large quantities of tires. However, it is not cost-effective as the result of being extremely labor-intensive and the availability of other lower cost materials.

56855 **(SAND—88-1305) RIBS: Rigid body simulation of the motion of two stages in a booster system.** Dohrmann, C.R. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1988. Contract AC04-76DP00789. 41p. NTIS, PC A03/MF A01. Order Number DE89001278/JAW.

A method for simulating the motion of two stages in a booster system described. The analysis of the motion considers both the separation and independent motion of the two stages. During separation, the stages may be pushed apart through a combination of thrusters and springs. A guide which is assumed frictionless and in perfect sliding contact partially restricts relative motion between the stages during separation. Throughout the motion, time-dependent forces that are specified beforehand may be applied to either of the stages. Equations of motion are numerically integrated in the computer program RIBS, which may be used to assist in the evaluation of different designs and deployment options. The input file and output options for RIBS are described in detail in this report and example problems provided. 3 refs., 15 figs., 1 tab.

56856 **(STC—76-80) Travel to work, 1976-1980.** (Statistics Canada, Ottawa, Ontario). 1982. 62p. (In English and French). (CE—01790). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Statistical surveys of commuting in Canada showed that public transit ridership for travel to work increased by 6% in 1980, whereas automobile usage was up only 4%. This is in contrast to the 1976 to 1979 period when most of the increase in commuting was accounted for by the automobile. The proportion of commuting drivers using larger vehicles weighing 4,200 pounds or more continued to decline, down in 1980 to 13% from 27% of the total as recently as 1976. Overall this loss of larger vehicles has been replaced on the journeys to work by increasing proportions of smaller cars, particularly by those weighing less than 3,000 pounds, and other vehicles such as vans, campers and trucks. Other estimates from the November 1980 survey indicate that there were 6.8 million persons travelling to work in 5.7 million automobiles. There were also 1.4 million persons who rode to work by public transportation. A further 1.0 million commuters walked to work or used other means of transportation such as a taxi, a motorcycle or a bicycle. In addition to these 9.1 million commuters there were 1.6 million other employed persons in Canada in November 1980. Of these, 0.9 million reported that they travelled "zero" miles to work and 0.7 million indicated that the distance varied from day to day. The proportions of commuters using each major mode have only changed slightly between 1976 and 1980, with between 70 and 75% using the automobile, with well over two thirds of these driving alone, 15% using public transit and 10% walking. 6 figs., 23 tabs.

56857 **(TC—83) Road energy technology assessment.** (Transport Canada, Ottawa, Ontario. Research and Development). [1983]. 127p. (CE—01896). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The objective of this study was to assess the effectiveness of road transportation energy technologies currently the subject of research and development (R&D) in Canada. These technologies would be associated with energy conservation, new liquid fuels, and energy transportation. A methodology and framework was to be developed that would enable identification of gaps in technology development, and to suggest new technologies to be developed and incorporated into new or existing programs. Industrial, university, and government programs at all levels were identified, along with technologies not currently the focus of Canadian R&D. Criteria were developed for assessing the technologies and the programs. Using the quantitative criterion and weight factors developed, technologies and projects were ranked, and R&D gaps identified. Separate assessments were developed for new liquid fuels and for energy conservation. The fuels/technologies projects were evaluated for technical/environmental, economic/marketing, and policy-related considerations. Overall needs can be summarized as follows. R&D needs for new fuels are greater than for conservation measures, and R&D is required for regulatory changes necessary to provide an environment for new liquid fuels. Cost/benefit models are required for general application to new fuels and technologies, taking into consideration all aspects of a fuels impact. Development of minimum acceptable vehicle performance standards could provide a useful benchmark. Other needs include fire fighting R&D and development of fuel specifications and labeling requirements. 23 refs., 12 figs., 16 tabs.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 56132, 56133, 56476, 56704, 56734, 56734, 56797, 56799, 56854

56858 **(ACS—8208) An economic update of the potential for cogeneration in Canada: industrial steam turbines.** (Acres Consulting Services Ltd., Niagara Falls, Ontario (Canada)). Aug 1982. 86p. (CE—01892). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A 1979 study of the potential for industrial cogeneration in Canada was reassessed in 1982 using updated financial and economic parameters. In general, the commercial potential for cogeneration has not improved. If the preferred fuel is natural gas, the commercial potential amounts to 220 MW, with average payback periods of 25 and 17 y with 0 and 2% real escalation in electricity prices (compared to 13 year payback in 1979). Using wood waste as a fuel in the forest industries, potential capacity improves to 970 MW, with payback periods of 18 and 13 y with 0 and 2% electricity price escalation. The fraction of commercially feasible projects was also not significantly changed from the 19% figure of 1979. The best penetration of commercially viable projects is in the Maritime provinces due to higher electricity prices, but these represent only 8% of the Canadian total. The greatest commercial potential is in the forest industries, followed by refineries and the iron/steel industries. In all industries the potential has declined from the 1979 study. On the other hand, the use of energy resource costs (shadow prices) reveals that almost all cogeneration projects identified in this Canada-wide survey are economically viable from a national perspective. If natural gas is the preferred fuel, the economic potential represents a capacity of about 2300 MW (ca 10 times the commercial potential). If waste fuels are used in the forest industries, the scope for economically viable electricity production is more than twice the quantity shown to be commercially feasible. 10 refs., 2 figs., 17 tabs.

56859 **(EFP—97) Dry desulfurization product as raw material for building components.** Nielsen, J.P.; Tram, B. (Bent Tram Consultants, Aalborg (Denmark)). May 1988. vp. (In Danish). Available on loan from Risoe Library, DK-4000 Roskilde.

EFP-87.

The report describes a number of investigations carried out with the purpose of finding useful applications for a waste product form the flue-gas cleaning process at coal-fired power plants, especially applications in the field of industrial building components. The waste product originates from a cleaning device, where the content of sulphur dioxide is removed from the flue-gas by the so called spray absorption method, developed by the Danish company Niro Atomizer A/S. The product is a finely divided, dry powder, consisting of a mix of calcium sulfite, calcium sulfate, calcium hydroxide, calcium carbonate, calcium chloride and fly ash. Trials were made, using the waste product mainly as a filler in the following products: Brick mortar, flue for ceramic tiles, stopping, filler for plastic paint, filler for plastics, filler for paper and paper-coating, autoclaved light-weight concrete, autoclaved fibre-cement sheets. The investigations has shown some interesting possiblilities for the use of named waste product in light-weight concrete, where good mechanical properties could be obtained, using a raw material mix, consisting mainly of the sulfuric waste product and fly ash. Also used as a filler in fibre-cement sheets, the waste material showed some interesting abilities. The waste product affects the properties of cellulosefibre reinforced sheets with a cementsilica matrix in a way, that leads to increased toughness of these, often rather brittle sheets. The MOR however will decrease slightly. (EG).

56860 **(EMR—01865) Barriers to the implementation of cost-effective energy-savig projects in industry. Industry series, No. 14.** (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada)). Dec 1982. 138p. (CE—01865). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The objective of this study was to identify barriers to the implementation of energy conservation projects in Canadian industry and to establish a numerical data base with which to gauge the importance of each barrier. By means of a literature search and experience, the most common barriers were identified. A questionnaire was developed to be used in an industry survey. The first part of the questionnaire was used as a means of establishing the main characteristics of the plant and the degree of interest and activity which had been undertaken or was planned for the plant. Also included were direct questions on the requisite return on investment before tax for energy saving projects, the problems regarding implementation of projects, and the areas in which energy conservation efforts were concentrated. The companies surveyed indicated

that most had undertaken energy audits and projects of low capital requirements. The second part was based on a concept of the development of projects in 7 stages, each of which may have a different set of problems: identification of possible schemes, conceptual designs, technical/financial feasibility studies, project funding, detail engineering, installation, and training and operation. The response to this part identified significant barriers besides lack of capital which impede implementing of projects. Results according to industry characteristics showed that the barriers are more evident in small, low energy user companies. There is no marked difference across Canada; however, the Atlantic region showed more concern regarding lack of technical expertise. The dominant feature in the early and crucial stages is the lack of management commitment. 22 refs., 21 figs., 10 tabs.

56861 **(EPRI-EM—5901-Vol.1) Plasma-fired cupola development: Volume 1, Summary: Final report.** Dighe, S.V. (Electric Power Research Inst., Palo Alto, CA (USA); Westinghouse Electric Corp., Madison, PA (USA). Waste Technology Services Div.). Sep 1988. 55p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89000572/JAW.

The traditional cupola is a vertical shaft furnace that through the years has been a major iron melting furnace in the foundry industry for the remelting of scrap iron and steel. The objective of the project was to demonstrate the advantages of a plasma-fired cupola versus a conventional cupola. In the plasma-fired cupola, a plasma torch is fitted at the bottom section of the cupola. It has the key advantages of providing energy for ion melting independent of coke combustion and using volumes of gas much smaller than commonly associated with the traditional cupola. The test program substantiated that the plasma torch can successfully operate in the extreme environment surrounding the tuyere region of the cupola. From the research, it can be concluded that potentially attractive savings can be obtained by substituting electric plasma energy for a portion of the fossil fuel energy in cupola melting operations. 12 figs., 4 tabs.

56862 **(EPRI-EM—5901-Vol.2) Plasma-fired cupola development: Volume 2, Description and analysis of test program and test unit: Final report.** Dighe, S.V. (Electric Power Research Inst., Palo Alto, CA (USA); Westinghouse Electric Corp., Madison, PA (USA). Waste Technology Services Div.). Sep 1988. 105p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89000573/JAW.

The traditional cupola is a vertical shaft furnace that through the years has been a major iron melting furnace in the foundry industry for the remelting of scrap iron and steel. The objective of the project was to demonstrate the advantages of a plasma-fired cupola versus a conventional cupola. In the plasma-fired cupola, a plasma torch is fitted at the bottom section of the cupola. It has the key advantages of providing energy for iron melting independent of coke combustion and using volumes of gas much smaller than commonly associated with the traditional cupola. The test program substantiated that the plasma torch can successfully operate in the extreme environment surrounding the tuyere region of the cupola. From the research, it can be concluded that potentially attractive savings can be obtained by substituting electric plasma energy for a portion of the fossil fuel energy in cupola melting operations.

56863 **(ESML—8206) Energy consumption on Canadian woodlands operations.** Ash, M.J.; Knobloch, P.C. (Energy System Management (ESM) Ltd., Mississauga, Ontario (Canada)). Jun 1982. 120p. (CE—01792). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The objective of this study is to provide an initial data base of present fuel requiremnets accounted for in Canadian logging operations. The aim of this data base is to compile consumption data by equipment type relying upon actual field data. For each sample of equipment, the statistics which were calculated include: total direct energy consumed; direct energy consumed per productive machine hour; direct energy consumed per unit of production; haul truck fuel mileage; some hydraulic oil consumption; and, for camps, direct energy consumed per man-day worked during a period. Equipment used for harvesting trees was assembled into typical harvesting systems. These systems are categorized by product-at-roadside (shortwood, tree-length, full-tree) and by the degree of mechanization. In addition, analyses of direct energy requirements were attempted for loading and transportation and for support services such as camps, transportation of men and equipment, and road construction and maintenance. As a result of the data collection and energy use investigation, opportunities are identified to reduce energy intensity of woodlands operations. An understanding of these energy conservation details as well as management support for implementing conservation strategies, is crucial for any energy reduction. The opportunities for conservation vary, in relative terms, for each operational phase. The variations or range of results for the equipment presented in this report are available in the data base. The degree of commitment to, and implementation of, potential energy saving options is open to re-evaluation by the industry as future scenarios are developed. 8 refs., 2 figs., 39 figs.

56864 **(LGL—8212) Development of an energy cascading plan for a typical Canadian industrial community.** (Lalonde, Girouard, Letendre and Associates Ltd., Montreal, Quebec (Canada)). Dec 1982. 45p. (CE—01891). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The purpose of this report is to develop the concept of waste heat recovery and reuse by formulating a preliminary energy cascading plan for recovering and reusing waste heat in a typical Canadian industrial community. It has been estimated that in 1978 the identifiable waste heat streams from Canadian industries contained 1,554 TBtu of energy. Analysis indicates that at least 25% of this heat is recoverable and reusable through the implementation of energy cascading technologies. It is intended that the plan developed in this report will provide a format for those concerned with efficient use of energy. It describes a methodology for preparing energy audits which can be used as a basis for developing a community energy cascading plan. The industrial community studied in this project is an existing community. The energy recovery and reuse plan is based on the 41 operating industries and a population of ca 70,000 who are consuming energy for residential and commercial heating. Energy audits and balances were prepared and analyzed to illustrate a preliminary planning methodology. The plan involved the cogeneration of electricity when steam was produced in some industrial plants, and a district heating system which would recover heat from industrial wastes and use it to meet 30% of the community's residential/commercial heating requirement. Combined energy savings from the reduction in purchased energy and in-plant cogeneration was 1,342 GBtu/y, or 232,000 bbl/y of crude oil equivalent. 14 refs., 4 figs., 16 tabs.

56865 **(MEM—82-114) Waste heat recuperator, Manitoba rolling mills.** (Manitoba Ministry of Energy and Mines, Winnipeg (Canada)). Jul 1985. Vp. (CE—01942). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report describes the results of the addition of a waste heat recuperator to a natural gas fired billet reheat furnace at a rolling mill located in Manitoba. In the operation of a steel rolling mill, excess heat is generated by the process only while operating; therefore, the use of recovered heat is restricted to a few process-related possibilities. Several alternatives for energy conservation were considered prior to selecting a waste heat recuperator designed to preheat the combustion air before entering the billet preheat furnace burners. Studies of the existing furnace indicated that approximately 50% of the heat in the fuel was lost due to high temperature stack gases. The recuperator, a 2-pass air-to-air tube type heat exchanger, was installed adjacent to the existing furnace. The old waste gas stack was blocked of and the hot gases re-directed by ductwork so that they passed through the recuperator and then discharged to the atmosphere through an ejector fan stack. The preheat combustion air is distributed to the roof burner stystem of the reheat furnace via insulated ductwork. The project combined energy savings resulting from the addition of the recuperator and controls amount-

ed to 31%. This would be equivalent to $576,000/y at present gas prices and a 200,000ton/y production rate. To date, overall energy consumption has been reduced ca 31%. Further work on furnace control optimization is in progress and additional energy consumption savings are anticipated. Production improvements have also resulted from the conservation program. The billets are more uniformly heated, with less scale formation, and capacity has been increased beyond the previous 80 tons/hour maximum. 2 figs.

56866 **(MU—8703) Routing and scheduling within a job shop framework.** Blazewicz, J.; Laparte, G. (Montreal Univ., Quebec (Canada). Centre de Recherches Mathematiques). Mar 1987. 11p. (MICROLOG—88-00542). Centre de recherche sur les transports, Universite de Montreal, CP 6128, Succursale A, Montreal, P.Q., Canada H3C 3J7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In this paper, an extension of the classical industrial production scheduling problem is considered. It is assumed that tasks are processed on parallel processors, available at different production sites. Each task also requires for its processing additional (reusable) resources which, at the beginning, are available at resource sites and production sites. The problem is to find a schedule for processing all the tasks and transporting the resources required between resource and production sites in order to minimize certain objective functions, such as transport cost. In this paper, several variations of the problem are considered and mathematical programming formulations for each subproblem are given. 9 refs.

56867 **(NEI-FI—40) Water and energy conservation research of cooling systems.** Suikkanen, J.; Bacher, F.; Lindgren, K. (Orion Yhtymae Oy, Noiro (Finland); Kupari Oy, Espoo (Finland)). (Insinoe Oeritoimisto Kupari Oy, Espoo (Finland)). Jun 1987. 24p. (In Finnish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754867/JAW.

The company Orion-Yhtymae Oy Noiro uses cooling water for process cooling in a cosmetics works and for manufacturing paraffine powder in a candle factory. The existing cooling is performed partly by service water and partly by ditch water. The disadvantages of the system are high operating costs, waste of energy, bacteria risk because of ditch water and the ineffectiveness of the cooling during the summer time. If the cooling system of the cosmetics works were converted to a mechanical cooling system, the pay-back period of the investment would be less than four years when the equipment is furnished with heat recovery. In the candle factory, the pay-back period of the mechanical cooling investment is less than one year because the operating time of the equipment is long and the cooling effect rather small.

56868 **(NEI-FI—41) Energy consumption and energy conservation in Oy Lohja Ab Uniplast factory.** Kippilae, K.; Hagstroem, B. (Lohja Oy Uniplast, Lohja (Finland)). 1987. 60p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754868/JAW.

Energy consumption and major energy conservation possibilities were studied in Oy Lohja Ab Uniplast factory. The plant manufactures different kind of plastics products. The biggest conservation potential is in space heating. As a result the following items are represented to Uniplast for further proceeding: Improve the boilers combustion efficiency. The stack losses shall be reduced. Figures to be achieved in the flue gases: concentration of CO/sub 2/=12%, temperature 200 deg C and smoke test value (Bacharach number) = 0-1. If these values are achieved 17% of the annual oil consumption can be saved. (Annual oil consumpition is 3580 MWh). Stop warming up of the supply air outside the working hours. The supply air and exhaust air devices are to be stopped and started by a timer device. Circulation air is to be used outside the working hours. The energy conservation potential is about 700 MWh/a. Reduce the power consumption outside working hours. The leaks in the compressed air system cause most of the power consumption during the nights and week-ends. Shut-off ball valves are to be installed in the compressed air ducts at every pneumatic tool. Utilize the condensate heat from the refrigerator. The refrigerator is in fact a heat pump. If the freon were circulated through supply air preheating batteries 160 MWh/a energy would be saved. Summary and heavy oil conversion. By performing the proposed items 1.2 and 4 the annual light fuel oil consumption is reduced by 40% compared with the figures of 1985. The possible conversion to heavy fuel oil is feasible only in case that the items 1 and 2 will not be performed, or if there will be otherwise enough heat load for an at least one megawatt boiler.

56869 **(NEI-FI—45) Development of control systems for new low-energy batch cooking processes.** Anttila, V.; Kuusela, M.; Pesu, K.; Ryynaenen, M.; Sihvola, E.; Talvala, M.; Tuderman, M.; Vaeisaenen, E. (Oy Advanced Forest Automation Ab, Helsinki (Finland)). (Kauppa-ja Teollisuusministerio, Helsinki (Finland). Energiaosasto). 1987. 77p. (In Finnish). NTIS (US Sales Only), PC A05. Order Number DE88754871/JAW.

The target of this project was to develop an appropriate control philosophy and software for new low-energy batch cooking processes. One of the new low-energy methods is RDH, Rapid Displacement Heating, which uses the heat energy of displace hot liquor from the previous completed cook for heating the next cook. From mill-scale operating experiences using the RDH pulping process, the consumption of primary heat was shown to be 60-75% less compared to batch cooking. Additionally, the cooking liquor displacement corresponds to one stage of filter washing. The pulp strength properties are better than those of conventional sulfate pulp, because the cold blow of the RDH process is more gentle on the pulp. Processes improving the heat economy utilize a complex liquor circulation that does not exist in conventional pulping process. Because of difficulties in controlling the liquor system as well as the more complicated cooking cycle, a higher level control system is necessary so that at least it is possible to have the digester house operating properly with the new processes. It is otherwise impossible to achieve target production without a higher level optimization system.

56870 **(NEI-FI—49) Test of heat recovery from crisp bread ovens.** Hagner, B. (Suomen Sokeri Oy, Vaasanmylly, Kotka (Finland)). Mar 1987. 21p. (In Finnish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754872/JAW.

The crisp bread ovens waste energy 11 400 MWh per year. The problems making the heat recovery difficult are unpurities and corrosive gases. During this research project a scrubber type heat recovery system was tested. Also a glas tube heat exhanger was tried to be tested, but it wasn't able to last temperature of 200 deg C. Heat from the scrubber was used for air conditioning by means of a plate heat exhanger. The system worked technically. The effectivity was moderate when using those temperatures of water which existed. To help cleaning work some little changes must be done in the construction of the scrubber. The water strippers must be cleaned after 2-3 weeks use. The main problem with the heat recovery plant is the high temperature of the water returning from the heating system. Try to low this temperature is already going. Because of the low price of oil the economy of the heat recovery plant isn't just now good.

56871 **(PB—88-230198/XAB) Utilization of scrap preheating and substitute slag conditioners for electric-arc-furnace steelmaking. Report of Investigations/1987.** Elger, G.W.; Nafziger, R.H.; Tress, J.E.; Hartman, A.D. (Bureau of Mines, Albany, OR (USA). Albany Research Center). 1987. 34p. (BM-RI—9130). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600192.

The preheating of continuously fed, fragmented ferrous scrap charges by furnace offgases and the utilization of substitutes for imported fluorspar to condition electric steelmaking slags were investigated. Three types of continuous scrap-charging procedures were investigated to determine electrical energy consumption in a 1-st (short ton) electric arc furnace. Cold and preheated scrap charges were continuously fed at rates averaging 37.5 and 43.7 lb. min, respectively. The feed rate varied appreciably from test to test owing to hangup of the scrap in the charge bin. Approximately 7 pct less electrical energy was consumed in melting scrap preheated to 840 to 1,110 F by furnace offgases than in melting cold scrap. Overall energy consumptions were 888 kW per h/st for cold scrap, 829 kW per h/st for preheated scrap, and 637 kW per h/st for con-

ventional backcharged scrap. Stack gases from scrap preheating averaged 120 F and a flow rate of 1,615 standard cubic feet per meter (scfm) compared with 220 F and 1,302 scfm for cold-charged scrap.

56872 (PB—88-233879/XAB) Supplementary-fired heat-recovery module. Final report, October 1983-April 1988. Smith, K.O. (Solar Turbines, Inc., San Diego, CA (USA)). Apr 1988. 55p. NTIS, PC A04/MF A01.

The design, fabrication, and testing of a supplementary-fired heat-recovery module (HRM) are described. The HRM is intended for industrial cogeneration applications in conjunction with gas turbines in the 500- to 1000-kW size range. Major subsystems of the HRM include: the natural gas-fired supplementary burner, once-through boiler, water-treatment system, and controls. The boiler is designed to provide saturated steam at 12.7 x 10^5 Pa (175 psig) or lower and can be fired up to 1256 K (1800 F) with the supplementary burner. The HRM is intended to improve cogeneration economics by providing larger, prepackaged, standardized steam systems for industry. Industrial market data that directed the HRM design are presented.

56873 (PB—88-867718/XAB) Recycling plastic scrap: injection molding. January 1973-August 1988 (Citations from the Rubber and Plastics Research Association data base). Report for January 1973-August 1988. (National Technical Information Service, Springfield, VA (USA)). Aug 1988. 54p. NTIS PC N01/MF N01.

Supersedes PB—87-860862.

This bibliography contains citations concerning the recycling of scrap plastic produced in the injection-molding process. Plastic pellets made from scrap that are used in the injection-molding process are also discussed. Recycling equipment and automated recycling systems are described. Ways to utilize plastic scrap from used cars, packaging materials, and waste from polyurethane production are presented. (This updated bibliography contains 102 citations, 13 of which are new entries to the previous edition.)

56874 (STF—11A87065) Drying processes. Stroemmen, I. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Nov 1987. 13p. (In Norwegian). (CONF-8711231—1). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754890/JAW.

From Conference on the heat pump in the energy supply; Haugesund, Norway (18 Nov 1987).

The report deals with energy conservation in industrial drying processes, and focuses on the development and cost of heat pump equipped fish drying plants in Norway. In order to optimize heat pump systems in general, the methods of simulation and testing are to be used. 5 drawings, 5 tables.

56875 (STF—11A87078) Report from the 17th International Congress of Refrigeration, Vienna, 24-29 Aug 1987. Lystad, T. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Dec 1987. 101p. (In Norwegian). (CONF-870854—SUMM.). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88754893/JAW.

From 17. international congress of refrigeration; Vienna, Austria (24 Aug 1987).

The report reviews the papers presented at the 17th International Congress from the Division of Refrigeration Engineering, SINTEF, Trondheim, Norway. The papers cover the following aspects: Test facility for cheat transfer and pressure drop in coil wound, mixed refrigerant heat exchangers; optimization of dry expansion air coolers; heat pump, and heat exchanger for process water heating in fish farming plants; the influence of storage, freezing, and thawing on fillet yield of fish; energy utilization in a fish processing plant; the influence of the evaporator tin spacing on defrosting cycles and front veocity in electrically driven air-based heat pumps; thermodynamic and physical properties stored in tables for multistream heat exchanger simulation; ice production in tropical fisheries; compressor performance test rigs for shaft power up to 500 kw; three-dimensional calculation of soil freezing using concentric pipes. 56 drawings, 4 tables, 41 references.

56876 (STF—15A88002) Energy conservation for thermo-technical processes in industry. Loeken, P.A. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Jan 1988. 15p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754897/JAW.

The report presents the analyses done on energy conservation potentials for the existing thermo-technical processes in the Norwegian industry. Interesting potentials are pointed out, and the analyses demonstrated that the processes seem to be efficient as regards the optimum utilization of supplied energy. Software is developed for the analysis of industrial processes. 30 references.

56877 (SVF—301) Use of industrial by-products for covering tailing-dumps. Mattsson, E.; Qvarfort, U. (Stora Teknik, Falun (SE); Uppsala Univ. (SE). Dept. of Quaternary Geology). (Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden)). Apr 1988. 50p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755113/JAW.

The study deals mainly with the following items. 1. Laboratory test of different fly ash and activated sludge from Kvarnsveden Papermill and mixtures between them. 2. Practical considerations on the application of fly ash and activated sludge mixed blankets. By means of permeability, mechanical properties and water-bound characteristic a mixture of coal/woodash and activated sludge 70:30 can be a layer with the efficiency of blocking the oxygen diffusion. Field tests indicated also that the conductivity values are almost the same in the field as in the laboratory. The chemical properties of the mixture and some soaking tests indicate that the percolating water emanating from the layer only will contain minor element contents. Fly ash and activated sludge can be mixed by a machine mixer and then spread after the mixing process by use of different trucks. To prevent the capillary barriers the layer must however be covered with an upper layer of suitable material. (authors).

56878 (SVL—62) Stabilized fly ash as basecourse. Gamst Jensen, O. (Statens Vejlaboratorium, Roskilde (Denmark); Miljoeministeriet, Copenhagen (Denmark). Skov- og Naturstyrelsen). 1987. 51p. (In Danish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754886/JAW.

The aim of the project was to investigate the conditions for the possible use of stabilized fly ash as a basecourse in road constructions in order to make use of waste products and to save natural gravel resources. The qualities of the stabilised fly ash were investigated in respect of cracking, development of strength and practical handling, including mixing and construction plant. Finally the economic aspects should be considered. The resources available did not make detailed examinations of all questions possible, and accordingly the number of definite findings are limited. 4 different types of Danish fly ash were stabilized with cement of lime, with or without additives and sand. Cylindrical specimens (1536 pieces) were tested for compression and tensile strength after 28 and 91 days and a maturity model for cement stabilized fly ash was developed. A pan-mixer is clearly preferable to a drum-mixer. Apart from this fly ashes are easy to handle with common road construction equipment. Recommendations: More basic research concerning strength, strength development and testing of durability. Furthermore coordination of the planning of test-fields and the collection of experiences.

56879 (SVL—194) Test roads with fly ash as basecourse. Gamst Jensen, O. (Statens Vejlaboratorium, Roskilde (Denmark)). 1986. 41p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754887/JAW.

In the summer of 1985 construction roads at a building site at the Amager Power Station were established, which eventually were to be used as normal roads for medium traffic. In connection with a project "Stabilized fly ash in basecourses" under The National Forest and Nature Agency, Elkraft Power Company Ltd, constructed a road of 400 m length (6 m wide) divided into 4 test stretches in order to examine methods for mising, laying and compaction of the basecourse consisting of cement- or lime stabilized fly ash. The results of these tests can be seen in the present note. With a paddle mixer, it is possible to obtain a very homogenous

mixture of fly ash and cement of lime, without the addition of sand or any other special efforts. Laying and compaction cause no difficulties. With normal compaction efforts it was possible to obtain a very satisfactory compaction of cementbound fly ash (FA) whereas this was not the case with lime-stabilised fly ash. One type of fly ash (ASV) produced lesser strengths than the other types (AMV). Cross-going construction traffic caused damages along the edges in the unstabilised stretch (4) and the stretch stabilised with lime (3). In these areas, there are also signs of unsatisfactory drainage. Stretch 1 to 3 with cement or lime stabilization appear to show no frost damages in the winter 1985/86, and the unstabilized stretch 4 has risen 0-4 cm. A reference stretch with gravel basecourse has risen 0-1 cm.

56880 **(SVL—195) Car park with fly ash basecourse.** Gamst Jensen, O. (Statens Vejlaboratorium, Roskilde (Denmark)). 1986. 22p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754888/JAW.

In the Note, preliminary tests for and measurements during the construction of the fly ash basecourse of a parking place for private cars is described. The basecourse is divided into 3 different areas, in part not stabilized, in part stabilized with 3 and 6 parts RC. The thickness of the basecourse is 20 cm. This has been laid on a 30 cm sub-base, consisting of slag from coal-fired power stations, and it was covered by 8 cm thick concrete block paving, laid on a 3 cm thick layer of sand. The compressive strength after 91 days of the fly ash stabilized with 6 parts RC was 4 times as great as the compressive strength of the unstabilized materials or the fly ash with 3 parts RC. Mixing the materials with a concrete mixer did not give a completely homogenous mixture. Lumps of (pure) fly ash were visible in samples and in contrast impregnated polished sections.

56881 **(SVL—197) Maturity-model for cement stabilized fly ash.** Schou, J.; Freiesleben Hansen, P. (Statens Vejlaboratorium, Roskilde (Denmark)). 1986. 31p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754889/JAW.

Based on compressive tests of test samples of varying ages and stored at different temperatures, a calculation model has been proposed (maturity function) for the development of strength at different temperatures. The composition of the test samples was as follows: 100 weight percent fly ash (NRL nr. 13), 25 weight percent sand with approx. 9% lime, 37 weight percent water, 10 weight percent standard cement (PFC(A)). The results indicate that an increase in strength is obtained by two sparate reactions: a cement reaction followed by a fly ash/lime reaction. A diagramme is drawn up for the determination of the influence of temperature on the speed of the hardening. The development of strength is slow and the compressive strength after one year lies between 5 1/2 to 7 MPa. The fly ash reaction only commences 10-40 days after casting.

56882 **Process for removing metals from water.** Napier, J.M.; Hancher, C.M.; Hackett, G.D. US Patent Application 6-067,073. 29 Jun 1987. 13p. Contract AC05-84OR21400. NTIS, PC A03/MF A01.

A process for removing metals from water including the steps of prefiltering solids from the water, adjusting the pH to between about 2 and 3, reducing the amount of dissolved oxygen in the water, increasing the pH to between about 6 and 8, adding water-soluble sulfide to precipitate insoluble sulfide- and hydroxide-forming metals, adding a containing floc, and postfiltering the resultant solution. The postfiltered solution may optionally be eluted through an ion exchange resin to remove residual metal ions. 2 tabs.

56883 **Anaerobic microbial dissolution of lead and production of organic acids.** Francis, A.J.; Dodge, C.; Chendrayan, K.; Quinby, H.L. US Patent Application 6-039,131. 16 Apr 1987. 18p. Contract AC02-76CH00016. NTIS, PC A03/MF A01.

The present invention related to an anaerobic bacterial culture of Clostridium sp. ATCC No. 53464 which solubilizes lead oxide under anaerobic conditions in coal and industrial wastes and therefore presents a method of removing lead from such wastes before they are dumped into the environment. The rat of lead dissolution during logarithmic growth of the bacteria in 40 ml medium containing 3.32 μmoles of lead as lead oxide was 0.042 μmoles m1/sup {-}1/ hr/sup {-}1/. Dissolution of lead oxide by the bacterial isolate is due to the production of metabolites and acidity in the culture medium. The major metabolites are acetic, butyric and lactic acid. The major metabolites are acetic, butyric and lactic acid. Clostridium sp. ATCC No. 53464 can be used in the recovery of the strategic metals from ores and wastes and also for the production of lactic acid for commercial purposes. The process yields large quantities of lactic acid as well as lead complexed in a stable form with said acids. 4 figs., 3 tabs.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 56436, 56774, 56805, 57518, 57551

56884 **(BNL—41433) Optimal selection of district cooling technologies using the Brookhaven analysis model.** Andrews, J.W. (Brookhaven National Lab., Upton, NY (USA)). Jun 1988. Contract AC02-76CH00016. 23p. (CONF-8806229—1). NTIS, PC A03/MF A01. Order Number DE88015849/JAW.

From 79. IDHCA conference; Chautauqua, NY, USA (26 Jun 1988).

This paper discusses the use of a computer model developed at Brookhaven National Laboratory, the purpose of which is to identify sub-regions within a metropolitan area for which district heating and cooling is most feasible economically, and to determine which of a group of competing system configurations is most cost-effective. A study of district heating in Milwaukee, Wisconsin, is used to illustrate the use of the model, and then an ongoing study of district cooling in Austin, Texas, is described. Current experience highlights the need to be able to utilize incomplete data, and data whose nature varies from one municipality to another. 5 refs., 12 figs.

56885 **(CONF-8705302—2) The effects of environmental factors on acid-phase digestion of sewage sludge.** Henry, M.P.; Sajjad, A.; Ghosh, S. (Institute of Gas Technology, Chicago, IL (USA)). 1987. 23p. NTIS, PC A03/MF A01. Order Number DE88017159/JAW.

From 42. Purdue industrial waste conference; West Lafayette, IN, USA (12 May 1987).

The two-phase anaerobic digestion process consists of two fermenters operated in series, wherein the acidification and gasification reactions are optimized in separate reactors to improve the overall system conversion efficiency. This paper discusses the results of tests conducted with bench-scale complete-mix acid-phase digesters to determine the effects of culture pH, temperature, and hydraulic retention time (HRT) on the efficiency of sewage sludge digestion. Tests were conducted at culture pH's of 5, 5.5, 6, and 7 at mesophilic (35{degree}C) and thermophilic (55{degree}C) temperatures and at HRT's of 1.3 and 2 days. Digestion efficiencies were determined on the basis of volatile acid production, gas production, and the reduction of the major particulate components of the feed sludge (crude protein, carbohydrates, and lipids). Efficiencies were highly dependent on each of the three control factors and were generally optimized at the higher extremes of pH, temperature, and HRT tested. 9 refs., 2 figs., 10 tabs.

56886 **(EPRI-P/EM—6019-Vol.1) Utility competitive assessment methods: Volume 1: Issues and methods: Final report.** Leone, R.A.; Leonhard, J.H.; McWhinney, R.T. Jr. (Electric Power Research Inst., Palo Alto, CA (USA); Putnam, Hayes and Bartlett, Inc., San Francisco, CA (USA)). Sep 1988. 79p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89000254/JAW.

Competitive pressures are increasing in the electric utility industry due to a variety of factors. A framework was developed to help utilities deal better with the transition toward increased competition. Various competitive assessment methods, not generally used by electric utilities, are reviewed for their application to an increasingly competitive utility environment. Four case studies were

developed that show the application of competitive assessment methods by different utilities (Volume 2). 130 refs., 15 figs.

56887 (ORNL/CON—260) Effects of energy-efficiency programs on load-growth uncertainty for electric utilities. Hirst, E. (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 42p. NTIS, PC A03/MF A01. Order Number DE89001306/JAW.

Electric utilities face a variety of uncertainties that complicate their long-term plans to acquire future resources. These uncertainties concern future load growth; the performance and lifetimes of existing generating plants; and the costs, lead times, and performance of new demand and supply resources. Conservation programs can both provide cost-effective resources and reduce uncertainties. Programs that improve the energy-efficiency of new residential, commercial, and industrial buildings reduce uncertainty about the effects of economic growth on load growth. Different types of programs aimed at new buildings affect differently the uncertainties associated with consumer decisions concerning the technical efficiencies of new buildings. For example, standards that require new buildings to use less than a certain amount of electricity per unit floor area reduce uncertainty related to decision making by the builders and owners of new buildings. Rebates that help pay for efficiency improvements have a much smaller effect than do standards on these decision-making uncertainties. Considering the uncertainties associated with both economic growth and consumer behavior also shows that standards reduce uncertainties more than do rebates. 24 refs., 17 figs., 4 tabs.

56888 (PNL-SA—15588) Where are the controls on the conservation power plant?. Stokes, G.M. (Pacific Northwest Lab., Richland, WA (USA)). 6 Jul 1988. Contract AC06-76RL01830. 14p. (CONF-880814—16). NTIS, PC A03/MF A01. Order Number DE88015937/JAW.

From Summer study on energy efficiency in buildings; Pacific Grove, CA, USA (28 Aug 1988).

The concept of a conservation power plant is a powerful idea. This supply-side viewpoint of conservation has been tested in the Hood River Project and is a major element of the long-term strategy of some utilities, such as the City of Austin, which is planning to "acquire" a 553 MW conservation power plant over the next decade. The conservation power plant is, however, more than a convenient and compelling metaphor. This paper examines the problem of the control of the conservation power plant in real operation. It emphasizes three elements of control: the need for control, real-time and near-real-time measures of conservation power plant performance, and implementation strategies for controls. The approach to the problem is based on a hierarchial analysis of electrical distribution systems. This analysis identifies the key points within a utility distribution system at which information can be collected. The strategy emphasizes the use of a great deal of information normally available within a utility, such as billing data and substation monitoring, as well as the use of limited end-use data collection. Issues of conservation implementation strategies and long-term efficacy of conservation measures will be addressed. 9 refs., 2 figs.

3209 Education And Public Relations

REFER ALSO TO CITATION(S) 56826

56889 (CAA—8105) A survey of the public's attitudes toward the energy situation. Vol. 1. (Consumer and Corporate Affairs Canada, Ottawa, Ontario). May 1981. 246p. (CE—01928). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The objectives of this study were to: identify Canadian public attitudes toward the energy situation, particularly with respect to energy strategies and energy prices; identify public attitudes towards energy conservation; identify public knowledge of potential energy saving behaviors; identify current energy conserving behaviors as used by the Canadian public; and identify public reaction to general policy alternatives concerning energy, and to specific Canadian government programs concerning energy. Data were collected from telephone interviews conducted in eight cities across Canada. Some highlights of the survey findings are as follows. There is a decreasing consciousness of the problems and implications of the energy situation compared with earlier surveys. 41% of respondents believe that the energy crisis is a hoax. The energy shortage ranked last in importance among six selected issues facing Canadians. Shortages of specific fuels were seen at two levels of concern: gasoline and heating oil at high concern, electricity and natural gas at about half that level. Nearly 30% favored increasing gasoline prices to world levels; such an increase would change gasoline-related habits. A series of possible energy saving actions showed varying levels of support, e.g. 57% for a tax on gas-heavy cars. Certain conservation practices have become common, such as low thermostat settings and regular furnace servicing. 30% of those using oil heat gave serious thought to switching to another fuel, and there is also evidence to show actual switching. 119 tabs.

56890 (CCA—8304) A survey of the public's attitudes toward the energy situation. Vol. 1. (Consumer and Corporate Affairs Canada, Ottawa, Ontario). Apr 1983. 281p. (CE—01938). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Data were obtained by telephone interviews in nine cities across Canada. Some highlights of the survey are as follows. About one in 12 respondents mentioned energy as a major problem facing Canada. About 50% regarded the energy crisis as a hoax, and the energy shortage ranked last among six selected issues. Regarding energy-saving behaviors, certain practices such as turning off lights and lowering thermostat settings have become common. Awareness of the government's home insulation program was high, and 60% of homeowners had added insulation in the last few years. 12% of those currently with home heating other than oil had recently switched from that fuel. More than one in three homeowners were planning energy efficiency improvements in the next 12 months. Strong support was registered for the importance of home insulation as a good investment. Declines were registered from earlier studies in the numbers of those agreeing that less energy is going to have to be used, that the solution to the energy situation is that Canadians will have to change their life styles, and that dependence on foreign oil will result if gas and oil consumption is not reduced. About 75% of vehicles kept at home are used for work and/or school trips, but only 21% of households participated in carpools. 63 tabs.

56891 (CCA—8305) Evaluation of the energy cost indicator demonstration program: a report on Canadian and United States field experiments. 2 Vols. Mauser, G.A.; Filiatrault, P.; Hutton, B.R. (Consumer and Corporate Affairs Canada, Ottawa, Ontario). May 1983. 66p. (CE—01914). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This paper reports on a series of year-long field experiments in British Columbia investigating the effectiveness of a prototype feedback device in reducing household energy use. The prototype tested in these experiments is called an Energy Cost Indicator (ECI). The ECI can monitor both gas and electricity consumption (but not fuel oil) and then displays total cost incurred in a series of easy-to-read LED displays. A single sample of 400 single-family, owner-occupied, fully detached residential accounts was selected from the greater Vancouver region. Accounts were then randomly assigned to one of four experimental conditions. Household energy consumption for all four groups was monitored every two months during the test year and for the preceding year. Households using ECI used 2.6% less energy than other households. This effect marginally significant is more impressive when the 45 households that reported experiencing technical difficulties with their ECI are excluded from the analysis, i.e. when absolute differences are analyzed rather than percentage differences. No sizeable differences were evident across experimental conditions in attitudes towards energy conservation, knowledge of energy use, nor in their household characteristics as reported in a posttest interview. Most respondents using ECI judged it and accompanying explanatory material to be useful. Only 1/3 of households said that they would pay for the ECI they then had. Over 50% saw the ECI helping them in the following ways: increased awareness that the house was always

using energy, increased knowledge of what uses energy, and motivation to conserve energy. More preferred to rent an ECI than to purchase one. Opinion was divided on government subsidization. 1 ref., 25 tabs.

56892 **(DOE/CE/64611—T1) The Energy and School Management Seminar and The Energy Manager System: Developmental state programs for institutional conservation: Final report.** (Vermont Dept. of Public Service, Montpelier). 31 Aug 1988. Contract FG01-86CE64611. 137p. NTIS, PC A07/MF A01. Order Number DE88017257/JAW.

The purpose of this program, as expressed in the grant application, has been to promote long-term energy efficiency in schools by creating a shift in how school administrators perceive the task of managing energy. A one-day seminar, "Energy and School Management", used state-of-the-art management training techniques to deliver the back-to-basics message that energy efficiency is cost-effective, and school administrators were invited to take responsibility for effectively managing energy use and expense in their facilities.

56893 (SESC—8806, pp 276-278) **Renewable energy education in Canadian schools.** Ramsay, J. (REIC Ltd., Willowdale, Ont.). 1988. Solar Energy Society of Canada, 3 - 15 York St., Ottawa, Ont., Canada K1N 5T4; $30.00 CAN. (CONF-8806251—; CE—01931).

From 14. annual conference of the Solar Energy Society of Canada, Inc.; Ottawa, Canada (22 Jun 1988).

Energy, Mines and Resources Canada has commissioned a study to provide the necessary background information and a strategy for implementing an information program on renewable energy in Canadian schools. The study was designed to provide an assessment of the status of renewable energy education, based on a survey of available classroom materials and a limited number of interviews with educators across the country. In the years since the energy crisis, renewable energy has found its way into the curriculum in most jurisdictions. At the same time, teacher interest is flagging in the face of decreased public concern and classroom materials are often outdated. But simply providing new information was not felt to be enough. The strategy recommended addresses the need to revitalize interest in renewable energy, build resources within the education community, provide leadership to the education community, and provide materials and support to teachers.

56894 **(WL/BE—8106) A survey of the Canadian publics attitudes towards the energy situation. Vol. 2.** Keller, G.; McDougall, G.H.G. (Wilfrid Laurier Univ., Waterloo, Ontario (Canada). School of Business and Economics). Jun 1981. 46p. (CE—01901). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Based on a 1981 survey of 1,600 male and female heads-of-households a report was prepared on the Canadian public's attitudes towards the energy situation. This report presents additional analysis of the 1981 data and draws some comparisons with the six previous annual surveys conducted in this area. The major objective of this report is to provide an understanding of the relationship between Canadians' knowledge, attitudes, behavior, and program support with respect to the energy situation. The following conclusions were reached. There has been a decrease in the number of Canadians who regard energy as a matter of concern. The possibility of an energy shortage continues to decline as a matter of importance. The major reason for concern is the cost of energy. Fewer people are engaging in energy conserving behaviors. Groups identified in previous years on the basis of attitudes and behavior were not identified in 1981. There was a lack of consistency in the results in 1981 which led to some surprising and counter intuitive implications. For example, those perceived as being hostile to energy conservation measures tended to support energy price/tax increases, and these perceived to be knowledgeable about conservation programs. Why this has occurred is not clear, but it may be that with the declining interest in energy, the issue is taking on a superficial nature for many people. The two most encouraging findings for those concerned with conservation are: 93% of the respondents agreed that spending money on insulation was a good investment, and 30% favored increasing gasoline prices to world levels within the next two years. 35 tabs.

56895 **(WL/BE—8306) A survey of the Canadian public's attitudes towards the energy situation. Vol. 2.** Keller, G.; McDougall, D.H.G. (Wilfrid Laurier Univ., Waterloo, Ontario (Canada). School of Business and Economics). Jun 1983. 74p. (CE—01915). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Based on a telephone survey of ca 1,900 male and female heads-of-households in nine cities, a report was prepared in 1983 on the Canadian public's attitudes towards the energy situation. This report presents additional analyses of the 1983 data and provides some comparisons with the eight previous annual surveys conducted in this area. The major objective of this report is to provide an understanding of the relationship between Canadians' attitudes, behaviours, and program support with respect to the energy situation. Some conclusions were as follows. Energy shortage is not an issue, rising energy prices are. Surprisingly, in light of the perception of energy prices, self reported conservation actions and behaviours declined in 1983 compared to 1982. Awareness and participation levels in oil substitution and home insulation programs are high and continued government activity in these areas appears warranted. A detailed analysis of two conservation behaviors - adding insulation and weatherstripping/caulking - provided some interesting results. Those who had performed these behaviors tended to be knowledgeable about energy, were satisfied that the money was well spent, and planned to do mere. Those who didn't, felt they had sufficient insulation/weatherstipping and many did not plan to improve the energy efficiency of their home within the next year. There has been a modest trend towards downsizing cars between 1981 and 1983. However, multiple car households still remain as disproportionately heavy users of gasoline. 42 tabs.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 56898, 56901

56896 **(ORNL/Sub—87-95918/1) Research program on reduced combustion chamber heat loss effects on alternative fuel combustion.** Daby, E.E.; Garwin, I.J.; Havstad, P.H.; Hunter, C.E. (Oak Ridge National Lab., TN (USA); Ford Motor Co., Dearborn, MI (USA). Engine Research Dept.). Oct 1988. Contract AC05-84OR21400. 149p. NTIS, PC A07. Order Number DE89001316/JAW.

A research program was conducted to determine the effects of thermal barriers in the combustion chamber of a diesel engine on the combustion and emissions of selected alternative fuels. Comparison of steady state fuel economy, exhaust emissions, and combustion data of heat insulated, baseline water-cooled, and high compression ratio engines were made using three fuels. Fuels believed to be representative of the year 2000 fuel were selected for the study. In fact, the light cycle oil fuel used was similar to CAPE.32 fuel (No. 6). Ceramic coatings and solid ceramic inserts were used to insulate the combustion chamber of the heat insulated, uncooled engine. Fuel economy and NOx emissions were generally lower for the heat insulated, uncooled engine than for the baseline engine and high compression water-cooled engine. Light load hydrocarbons were lower for the high compression ratio engine than for those of the baseline engine; however, hydrocarbon emissions for the heat insulated engine were higher than those of the baseline engine over the complete range of engine operating conditions tested. Heat insulating the combustion chamber and operating the water-cooled engine at elevated intake air temperature and high compression ratio reduced ignition delay and premixed combustion while increasing the amount of diffusion combustion. Further optimization of the combustion chamber, air motion, and the injection system of the heat insulated, uncooled engine may result in additional reduc-

tions in exhaust emissions not observed during this study. 59 figs., 2 tabs.

3302 External Combustion Engines

56897 (DOE/NASA/50112—76) Results from the Stirling-powered vehicle project: Phase 1. Shaltens, R.K. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). [1988]. Contract AI01-85CE50112. 15p. (NASA-TM—100978; CONF-881105—1). NTIS, PC A03/MF A01. Order Number DE88016868/JAW.

From 4. international conference on stirling engines; Tokyo, Japan (7 Nov 1988).

The NASA Technology Utilization (TU) Office is sponsoring a multiyear, multiphase demonstration program to assess the technology developed under the DOE/NASA automotive Stirling engine (ASE) program with engines installed in various Air Force vehicles while being evaluated by independent third parties under realistic conditions. This paper reviews the operational history of Phase I and a Mod I Stirling engine installed in an Air Force multistop van in a variety of missions. Ten months of operation were with Air Force personnel at Langley Air Force Base, Virginia, where over 1100 hr and 4000 mi were logged on the Langley flight line. The Stirling-powered van was operated on unleaded gasoline, JP-4 aircraft fuel, and diesel fuel at Langley Air Force Base. Two months of operation were completed with Deere & Company personnel in the Moline, Illinois, area where over 175 h and 2650 miles were logged on a Deere mail delivery route. 8 refs., 12 figs., 6 tabs.

3307 Emission Control

REFER ALSO TO CITATION(S) 56901

56898 (PB—88-232186/XAB) Effects of barium-based additive on diesel-exhaust particulate. Report of Investigations/1987. Zeller, H.W. (Bureau of Mines, Twin Cities, MN (USA). Twin Cities Research Center). 1987. 49p. (BM-RI—9090). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 86-600402.

The Bureau of Mines performed laboratory research to determine the effects of a barium-based fuel additive on diesel-particulate emissions. The test engine was typical of types used to power underground coal mining equipment. Test parameters consisted of baseline measurements without additive, three fuel-additive concentrations, and five steady-state engine loads, all at 1200 r/min. Additive effects on soot mass concentration, opacity, particle-size distribution, volatile fraction, and NOx emissions were determined. The additive reduced volatile hydrocarbons absorbed on filter deposits by up to 50 pct. At most engine loads, carbon particulate was also reduced. About 40 pct of the barium added to the fuel was accounted for in the exhaust. The health implications for miners were considered, but no firm conclusions were drawn or recommendations made.

56899 (STF—21A87094) Oxidation-reduction behaviour of platinium-rhodium alloys. Bergene, E.; Grepstad, J.K.; Holmen, A. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Nov 1987. 9p. (CONF-8611233—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88754899/JAW.

From Quantitative surface analysis (QSA-4) conference; Teddington, UK (18 Nov 1986).

The reduction behaviour of platinum-rhodium gauze catalysts used in ammonia oxidation have been investigated by XPS. The results are compared by corresponding measurements for vapour deposited films of platinum and platinum-rhodium. Low exposure (<10/sup 4/L) adsorption of oxygen at room temperature on freshly evaporated films of platinum and platinum-rhodium alloy is shown to generate a single strongly bound chemisorption state on the metallic surfaces. In contrast, room temperature oxidation by dry air at atmospheric pressure results in the formation of a weekly bound surface oxidation state, From the absence of chemically shifted rhodium oxide peaks in the platinum-rhodium data we conclude that this weakly bound surface oxygen is associated with platinum. When increasing the temperature to 400 degree C during air oxidation, a strong and sharp 01s photoline develops at 529.9+-0.2 eV binding energy. The data indicate formation of bulk platinum oxide, PtO/sub 2/ eV binding energy. The used platinum-rhodium gauze catalysts reveal excess surface concentration of rhodium and formation of stoichiometric rhodium oxide, Rh/sub 2/O/sub 3/. A complex 01s lineshape indicates the presence of at least two different oxidation states in the metallic state is shown to depend strongly on the concentration of rhodium. The presence of platinum appears to render the rhodium oxide less stable against reduction. 10 drawings.

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 56857, 56896

56900 (CONF-880180—3) The past and future of the petroleum problem: The increasing need to develop alternative transportation fuels. Santini, D.J. (Argonne National Lab., IL (USA)). 1988. Contract W-31-109-ENG-38. 30p. NTIS, PC A03/MF A01. Order Number DE88010048/JAW.

From 67. annual transportation research board meeting; Washington, DC, USA (11 Jan 1988).

A 20th century historical study of the interactions of petroleum supply and demand patterns and subsequent macroeconomic events suggests that the often-erractic behavior of the oil markets consistently contributes to economic instability. The obvious depletion of US oil reserves and the increasing importance of oil consumption in US transportation are argued to be causes for greater attention to the development of alternative (non-oil based) transportation fuels. Absent such development, the historical lessons in this paper suggest that another period of rising oil prices, erratic oil market behavior, and subsequent economic difficulty is probable within the next two decades. Methanol is argued to be the most likely and most desirable substitute transportation fuel, because it can be produced more economically and used more efficiently than gasoline when derived from the rapidly expanding worldwide supplies of natural gas.

56901 (PB—88-229406/XAB) Evaluation of a methanol-fueled (M85) turbocharged nissan sentra. Technical report. Blair, D.M. (Environmental Protection Agency, Ann Arbor, MI (USA)). May 1988. 31p. (EPA/AA/CTAB—88/03). NTIS, PC A03/MF A01.

Section 211 of the Clean Air Act requires that the United States Environmental Protection Agency (EPA) play a key role in the introduction of new motor-vehicle fuels. The Emission Control Technology Division (ECTD), of the Office of Mobile Sources, EPA assesses technology that could be used to reduce mobile source emissions, including evaluation of alternate-fueled vehicles. A turbocharged Nissan Sentra was emission tested at the U.S. EPA Motor Vehicle Emissions Laboratory located in Ann Arbor, Michigan. This vehicle was designed by Nissan to operate on M85 (85% methanol/15% gasoline) fuel. The vehicle's chassis is a late-1986 configuration while the engine is based on a 1983 1.3-liter design. The report includes individual test results using methanol-vehicle procedures, calculation of exhaust emissions, and individual test results using gasoline-vehicle procedures.

35 ARMS CONTROL

REFER ALSO TO CITATION(S) 56742

3501 Policy, Negotiations, And Legislation

56902 (AD-A—195079/9/XAB) Looking beyond the Strategic Defense Initiative. Study project. Nichols, D.H. (Army War Coll., Carlisle Barracks, PA (USA)). 30 Mar 1988. 48p. NTIS, PC A03/MF A01.

On 23 March 1983, President Reagan announced a new proposal. This study looks at the Strategic Defense Initiative (SDI) and how it will achieve the objectives President Reagan envisioned in his speech. It examines a scenario in which deterrence has failed

and the time for Presidential decision making is severely compressed. It then looks at Presidential decision making during such a crisis and examines his options. Next, it looks at how the SDI is envisioned to work and contribute to the ultimate goal of eliminating the threat posed by nuclear ballistic missiles. Last, it examines the possibility that SDI may create a world we do not want; a dangerous world in which conventional wars between the two superpowers would become possible, maybe even probable. It does this by examining its impact on NATO, particularly in light of the proposed Intermediate-Range Nuclear Forces treaty.

56903 (AD-A—195307/4/XAB) Challenge for NATO: improving conventional deterrence. Study project. Lynch, W.R. (Army War Coll., Carlisle Barracks, PA (USA)). 30 Mar 1988. 54p. NTIS, PC A04/MF A01.

The present thaw in US-Soviet relations with the INF agreement as a centerpiece poses a significant challenge for NATO. At a time of a reduced-threat perception and a renewed debate on NATO policy, it has become increasingly more apparent that the US should take the lead in developing a sound NATO course for the future. As NATO comes to grips with a new Soviet foreign policy direction and style, it will be necessary to reassess NATO strategy and doctrine. There will be a tendency to reduce defense spending based on a reduced-threat perception. The author feels this is the worst course we could follow, and the sound course is development of a strong conventional defense, which assures parity with the Warsaw Pact. A stronger conventional pillar can be part of a deterrent that compensates for theater nuclear deficiencies and accounts for continued force reductions. A key step to take is the development of a combined NATO doctrine at the operational and tactical levels. Finding the means for the strategy is not an insurmountable problem if NATO countries can develop a consensus to meet spending goals. The INF agreement will help to focus increased attention on the theater and strategic deterrent and it is argued that the US should take the lead in building a consensus for a strong conventional defense and deterrence capability which is coupled to nuclear deterrence.

3503 Verification

REFER ALSO TO CITATION(S) 57407

56904 (SAND—88-2155) Seismic attenuation models of Asian explosions recorded at NORESS. Walck, M.C. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1988. Contract AC04-76DP00789. 33p. NTIS, PC A03/MF A01. Order Number DE89001038/JAW.

NORESS recordings of presumed explosions in the Soviet Union provide spectral estimates of teleseismic attenuation along three paths from Asia to southern Norway. Two of the spectra require that attenuation varies with frequency, while the third is consistent with a constant path Q. Curve fitting using the Simplex algorithm is used to objectively determine model parameters that best fit the three data curves for five different attenuation model formulations. The derived model parameters are useful input information for computer codes designed to calculate signal detectability for hypothetical seismic networks, as are used for feasibility studies of seismic verification of a test ban treaty. 21 refs.; 10 figs.; 7 tabs.

36 MATERIALS

REFER ALSO TO CITATION(S) 56736, 58024

56905 Process for forming exoergic structures with the use of a plasma. Kelly, M.D. US Patent Application 6-055,219. 29 May 1987. 10p. Contract AC04-76DP00053. NTIS, PC A02/MF A01.

A method of forming exoergic structures, as well as exoergic structures produced by the method, is provided. The method comprises the steps of passing a plasma-forming gas through a plasma spray gun, forming a plasma spray, introducing exoergic material into the plasma spray and directing the plasma spray toward a substrate, and allowing the exoergic material to become molten in the plasma spray and to thereafter impinge on the substrate to form a solid mass of exoergic material, the shape of which corresponds to the shape of the substrate.

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 56255, 56261, 56282, 56302, 56304, 56306, 56309, 56322, 56324, 56547, 56548, 56591, 56592, 56592, 56593, 56593, 56619, 56899, 57081, 57129, 57254, 57262, 57985, 58023, 58195, 58257

56906 (AD-A—194836/3/XAB) Dynamic fracture-toughness evaluation by measurement of CTOD (Crack Tip Opening Displacement). Interim report. Sharpe, W.N.; Douglas, A.S.; Shapiro, J.M. (Johns Hopkins Univ., Baltimore, MD (USA). Dept. of Mechanical Engineering). 15 Mar 1988. 88p. (WNS/ASD—88-02). NTIS, PC A05/MF A01.

Quantification of the dynamic fracture toughness of structural materials is essential to a wide range of problems - from nuclear accidents to ordnance applications. However, the difficulties associated with accurate measurements of cracks under dynamic loading are considerable. Thus there are no standardized procedures and few reliable results. This work describes a systematic study of the dynamic fracture toughness of SAE-01 tool steel, 4340 and HY100 steels and a tungsten, using the ISDG (Interferometric Strain/Displacement Gage) system which has very-high-frequency resolution. The major advantage of the method is that information is obtained very close to the crack tip, so that stress wave loading effects are accounted for. A detailed error analysis gives an uncertainty of -10% to +20% in the determination of fracture toughness, which compares with + or - 20% for published work.

56907 (BNL—41669) Magnetic correlations in UPt_3 and U/sub 1-x/Th/sub x/Pt_3. Aeppli, G.; Bucher, E.; Goldman, A.I.; Shirane, G.; Broholm, C.; Kjems, J.K. (Brookhaven National Lab., Upton, NY (USA); AT and T Bell Labs., Murray Hill, NJ (USA); Risoe National Lab., Roskilde (Denmark)). 1988. Contract AC02-76CH00016. 17p. (CONF-880704—5). NTIS, PC A03/MF A01. Order Number DE88016730/JAW.

From 6. international conference on crystal field effects and heavy fermion physics; Frankfurt, F.R. Germany (18 Jul 1988).

Neutron scattering experiments on UPt_3 and U/sub 1-x/Th/sub x/Pt_3 are reviewed. At relatively high energies ({approximately}5 MeV), the magnetic fluctuation spectrum is modulated by the structure factor derived from short-range antiferromagnetic correlations where the two U ions in each unit cell are oppositely polarized. In contrast, at low energies ($\leqq$ 1 MeV), the diffuse inelastic scattering is associated with antiferromagnetic correlations where the unit cell is doubled. Nominally pure UPt_3 exhibits magnetic order with the wavevector corresponding to this doubling and a static moment of 0.02 +- 0.01 μ/sub B/. (U/sub 1-x/Th/sub x/)Pt_3 with $x \simeq 0.05$ exhibits ordering of the same type, but with a much larger static moment, 0.65 +- 0.1 μ/sub B/. Neutron scattering measurements on UPt_3 with implications for superconductivity are surveyed. 23 refs., 7 figs.

56908 (BNL—41761) Growth and electronic structure of Nb and Ta films on Pd and their interaction with CO. Jiang, L.Q.; Ruckman, M.W.; Strongin, M. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 17p. (CONF-881002—11). NTIS, PC A03/MF A01. Order Number DE89001104/JAW.

From 35. national vacuum symposium and 4th international laser science conference; Atlanta, GA, USA (2 Oct 1988).

The growth of Nb and Ta films on Pd(111) and their modification of CO chemisorption are studied using UPS, LEED, and low energy ion scattering (LEIS). At 300K LEIS shows significant amounts of Pd in the top layer even after more than a monolayer of Nb or Ta is deposited. This is in contrast to Pd on Nb or Ta(110) where a Pd monolayer completely covers the substrate. UPS shows that the surface electronic structure at monolayer Nb or Ta coverage resembles that of a Pd monolayer on Nb or Ta(110) and is characterized by strong Pd 4d emission 1-4 eV below Ef and a low density of states at Ef. Molecular CO adsorption is observed at submonolayer coverage, there is negligible CO adsorption at monolayer coverage and dissociative CO adsorption starts at greater than

monolayer coverage. It is concluded that the deposited Nb and Ta monolayers intermix with the Pd(111) substrate and it is also shown that this behavior can be understood by examining the energies of the system. 17 refs., 2 figs.

56909 **(CEA-DAS—498e) Evaluation of the french test reactors irradiation embrittlement experiments.** Miannay, D.; Dussarte, D.; Soulat, P. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 - (FR). Dept. d'Analyses de Surete; CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Dept. de Technologie). (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete). Jul 1988. 22p. (CONF-8710179—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754996/JAW.

From NEA/CSNI-UNIPEDE/NUCLE specialist meeting on life limiting and regulatory aspects of reactor core internals and pressure vessels; Stockholm, Sweden (14 Oct 1987).

The shifts of CV 41J energy index temperatures due to irradiation measured in France have been stored in a data bank and are analysed. According to a simple physically based model which is here-after verified, correlations are proposed for Base Metal (BM) and Weld Metal (WM). The achemical and phosphorus components of the chemical factor are equivalent. However, nickel and copper play a leading part in BM and WM respectively. The copper nickel interaction is not evident. These correlations are for cleavage fracture and not for intergranular fracture. This work is subject to revision and extension.

56910 **(CEA-tr—2236) Corrosion resistance of zirconium in nitric acid.** Kajimura, H.; Morikawa, H., Nagano, H. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jan 1987. 4p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755006/JAW.

Slow strain rate tests are effected on zirconium in boiling nitric acid to study the influence of nitric acid concentration, of oxidizing ions (Cr and Ce) and of electric potential. Corrosion resistance is excellent and stress corrosion cracking occurs only for severe conditions: 350 mV over electric potential for corrosion with nitric acid concentration of 40 %.

56911 **(DOE/ER/45172—T2) Implantation studies of hydrogen by field ion microscopy and spectroscopy: Final report.** Verink, E.D.; DeHoff, R.T.; Hren, J.J. (Florida Univ., Gainesville (USA). Dept. of Materials Science and Engineering). 15 Jan 1988. Contract FG05-84ER45172. 209p. NTIS, PC A15/MF A01. Order Number DE88016020/JAW.

For both fundamental and applied research in Materials Science there is widespread interest in ion implantation. This is particularly true in the field of tribology where the study of surface wear during sliding contact is especially important. The depth resolution of the Field Ion Microscope/Imaging Atom Probe (FIM/IAP) is of the order of a crystal d-spacing of the metal under investigation. The current study involves the application of the FIM/IAP to the study of low energy ions (<20 keV) implanted into nickel and tungsten to obtain depth profiles. Two ion species of immense technological importance were used, nitrogen and deuterium. Results of this investigation fall into four categories: 1) Instrumentation development. 2) Development of new experimental techniques, 3) The generation and interpretation of Experimental Data and 4) The determination of a number of characteristics of FIM which can influence the interpretation of experimental observations. 106 refs., 58 figs., 3 tabs.

56912 **(DOE/ID—10208) Techno-economic assessment of a carbothermic alumina reduction process.** (EG and G Idaho, Inc., Idaho Falls (USA); Little (Arthur D.), Inc., Cambridge, MA (USA)). Jul 1988. Contract AC07-76ID01570. 90p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE88015623/JAW.

Arthur D. Little, Inc., undertook an assessment of a process for the carbothermic reduction of alumina based on prior work and a flowsheet developed by a technical committee for the US Department of Energy. This report documents the technoeconomic assessment which identified potentially viable subprocess steps and their economic viability based on past research findings. Economic comparisons show the carbothermic process has the potential for lower capital and operating costs than the conventional Hall cell. Potential energy savings would be substantial through the use of carbothermic reduction of alumina. However, several of the selected subprocesses have not been reduced to practice, and there exists an opportunity to further improve the process economics through research and development. 11 refs., 8 figs., 11 tabs.

56913 **(DOE/ID/12443—2) Technology development for thin strip metal casting, Phase 2: Final technical report.** Williams, R.S. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 7 Mar 1988. Contract AC07-83ID12443. 177p. NTIS, PC A09. Order Number DE88013689/JAW.

The Phase II program has been conducted by a team of engineers from Westinghouse Electric Corporation and Armco, Inc., with the objective of providing a suitably sized experimental planar flow casting machine, and using it to perform casting trials to address the above technical uncertainties for cast thicknesses and speeds representative of industrial production, and with sufficient duration to diminish thermal transient effects. A nominally 7 ft. diameter water-cooled copper wheel planar flow casting system has been designed, fabricated and installed in a dedicated 15,000 sq. ft. foundry facility are Armco Inc., Middletown, Ohio. This system is capable of casting 3 in. wide strip and operating at surface speeds up to 25 ft/sec. Additionally, the facility also contains a 16 in. diameter water-cooled wheel with interchangeable casting substrates of different materials. This small wheel facility has been adapted to utilize the melt overflow process for casting of 3 in. wide strip. These casting facilities are supported by a 500 lb. induction melting furnace and necessary liquid steel handling equipment. Adequate techniques have been developed for transportation and filtering of liquid steel without undue temperature loss. Good control of the planar flow casting process was not achieved during this program, however given such control and the adoption of clean steel practices, the inference is that the process will be capable of producing strip which is readily cold-rollable in the as-cast condition. After cold rolling and annealing, such material should have useful mechanical properties. 8 refs., 112 figs., 10 tabs.

56914 **(FRCEA-TH—126) Influence of aging on low cycle fatigue and relaxation fatigue of alloy-800 grade 1 at 550/sup 0/C.** Regnard, C. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Metallurgie; Grenoble-1 Univ., 38 (France)). Oct 1987. 106p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755337/JAW.

Aging of alloy-800, material considered for fabrication of steam generators for fast neutron reactors, is analysed by microstructure study at different time intervals simulating long term behavior. Properties are strongly related to gamma precipitate size evolution and to a less extent by interstitial solute entrainement. Fine gamma precipitation representative of lifetime envisaged (2 x 10/sup 5/ hours at 525/sup 0/C) localizes deformation and increases creep embrittlement. Aged materials defined by large size precipitates allowing an homogeneous deformation is ideal for the utilization envisaged.

56915 **(FRCEA-TH—131) Elaboration and evolution in temperature of the amorphous alloy Tb/sub 65/Cu/sub 3 /5, study of short and medium range atomic order and low temperature magnetic order related to the elaboration process.** El Gadi, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique du Solide et de Resonance Magnetique; Paris-6 Univ., 75 (France)). Dec 1986. 147p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755338/JAW.

The thesis presents the study of the amorphous metallic alloy Tb/sub 65/Cu/sub 35/ prepared by rapid quenching and sputtering. Differential scanning calorimetry (DSC) measurements establish the annealing procedure needed to obtain a stable amorphous state through structural relaxation. Nearest neighbour distances as determined by neutron diffraction measurements shows a

high coordination for Tb atom and a relatively low one for Cu atom. In addition, small-angle neutron scattering (SANS) experiments carried out as a function of temperature show the existence of Tb bubbles with very high magnetization at low-temperature. The region between the bubbles shows composition fluctuations. The SANS measurements also indicate the coexistence of phases with compositions bordering the eutectic value and in the form of domains having sizes of a few thousand Angstroms. An unexpected result in the observation of an hundred fold increase in the intensity of low-angle magnetic scattering when the samples are hand-polished with simple sand paper. This clearly indicates the importance of sample surface state. Finally, this work establishes that samples prepared by two different techniques show identical properties.

56916 **(FRCEA-TH—144) Study of magnetic properties of TGa/sub 6/ with T = Ce, Pr, Nd, Tb, Ho, Dy and of solid solutions Ce(Ga/sub 1-x/ Al/sub x/)/sub 2/.** Jerjini, M. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale). Oct 1987. 200p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88755339/JAW.

At low temperature TGa/sub 6/ compounds are ordered with a Neel temperature of about 10 K. Magnetic structures are antiferromagnetic for T = Pr or Nd or modulated for T = Tb, Ho or Dy. Ce presents an abnormal behavior in CeGa/sub 6/. Neutron inelastic scattering allows the determination of energy levels in the crystal field of cerium ion and evidences hybridation of 4f and valence electrons. Three magnetic transitions for T < 1.7 K are an indication of complex magnetic order in CeGa/sub 6/. Study of CeGa/sub 6/ and solid solutions. Ce(Ga/sub (1-x)/ Al/sub x/)/sub 2/ shows that aluminium insertion reinforces the Kondo effect. For x = O.1 an incommensurable structure subsists at very low temperature. CeGa/sub 2/ is ordered with 3 magnetic structures. Magnetic moment is reduced with Al. The study of crystal field by neutron scattering shows that hybridation effects are more important for the compound with x = 0.1.

56917 (INIS-BR—1229, pp 20) **Implantation and thermal annealing behaviour of Bi implanted into Al/ti and A1/V bilayer structures.** Behar, M.; Fichtner, P.F.P.; Zawislak, F.C.; Olivieri, C.A.; Fink, D.; Biersack, J.P. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Sao Carlos Univ. (Brazil); Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

56918 (INIS-BR—1229, pp 6) **Hyperfine fields at sp sites in the Heusler alloys Rh/sub 2/MnZ (Z = Ge,Sn,Pb).** Jha, S.; Seyoum, H.M.; Julian, G.M.; Dunlap, R.A.; Vasquez, A.; Cunha, J.B.M. da; Ramos, S.M.M. (Cincinnati Univ., OH (USA); Miami Univ., Oxford, OH (USA); Dalhousie Univ., Halifax, Nova Scotia (Canada). Dept. of Physics). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

56919 (INIS-BR—1229, pp 7) **Moessbauer measurement of the hyperfine magnetic field at sp site in Heusler alloys Rh/sub 2/MnZ (Z = In and Sb).** Jha, S.; Seyoum, H.M.; Yehia, S.; Mitros, C.; Julian, G.M.; Dunlap, R.A.; Vasquez, A.; Cunha, J.B.M. da; Ramos, S.M.M. (Cincinnati Univ., OH (USA); Miami Univ., Oxford, OH (USA); Dalhousie Univ., Halifax, Nova Scotia (Canada). Dept. of Physics). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

56920 (INIS-BR—1229, pp 18) **Comparative study on intermetallic phases formed by direct ion implantation and enhanced diffusion of tin in two kinds of steel.** Dionisio, P.H.; Barros Junior, B.A.S. de; Baumvol, I.J.R. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

56921 (INIS-BR—1229, pp 41) **Helimagnetic structure in diluted Y-Gd alooys.** Brown, P.J.; Caudron, R.; Fert, A.; Pureur, P.; Givord, D. (Institut Max von Laue - Paul Langevin, 38- Grenoble (France); Office National d'Etudes et de Recherches Aerospatiales (ONERA), 92 - Chatillon (France); Paris-11 Univ., 91 - Orsay (France)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

56922 (INIS-BR—1229, pp 62) **Effects of trilinear symmetry breaking on the Potts-model transition of uniaxially stressed SrTiO/sub 3/.** Fontanari, J.F.; Theumann, W.K. (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

56923 (INIS-BR—1229, pp 3) **Magnetic hyperfine fields in Heusler alloys Co/sub 2/YZ (Y=TiZr; Z= Al,Ga,Sn).** Souza, S.D. de; Saxena, R.N.; Schreiner, W.H.; Zawislak, F.C. (Sao Carlos Univ. (Brazil). Dept. de Fisica; Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

56924 (INIS-BR—1229, pp 3) **Effect of pressure and temperature on the electric field gradient in the indium sites in compound of the In-Bi system.** Fries, S.G.; Maciel, A.; Jornada, J.A.H. da. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

56925 (INIS-BR—1229, pp 5) **Spin reorientation in (Er,Gd)Fe/sub 3/ compounds.** Cunha, J.B.M. da; Viccaro, P.J.; Vasquez, A. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

56926 (INIS-BR—1229, pp 40) **Magnetic rodering in YGd alloys.** Pureur, P.; Fert, A.; Wendler, R.; Baberschke, K. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Freie Univ. Berlin (Germany, F.R.)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

56927 (INIS-BR—1229, pp 40) **Magnetostriction of single crystals of yttrium doped with rare earths impurities.** Pureur, P.; Creuzet, G.; Fert, A. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Paris-11 Univ., 91 - Orsay (France). Lab. de Physique des Solides). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

56928 (INIS-BR—1229, pp 41) **Hall effect in Ce/sub 1-x/Y/sub x/ Pd/sub 3/ mixed-valence alloys.** Fert, A.; Hamzic, A.; Pureur, P.; Kappler, J.P. (Paris-11 Univ., 91 - Orsay (France); Rio Grande do Sul Univ., Porto Alegre (Brazil); Strasbourg-1 Univ., 67 (France)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

56929 (INIS-BR—1229, pp 42) **Spin-disorder resistivity in Ni/sub 2/Mn (Sn/sub 1-x/In/sub x/) heusler alloys.** Fraga, G.L.F.; Kunzler, J.V.; Brandao, D.E. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

56930 (INIS-BR—1229, pp 42) **Anisotropic thermal expansion of yttrium metal and yttrium - based rare earth alloys at low temperature.** Pureur, P.; Creuzet, G.; Fert, A. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Paris-11 Univ., 91 - Orsay (France). Lab. de Physique des Solides). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

56931 (INIS-BR—1229, pp 42) **Specific heat measurements in scandium-rare earth anisotropic spin glasses.** Pureur, P.; Fraga, G.L.F.; Brandao, D.E.; Candron, R.; Safa, H.; Nilva, G. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Office National d'Etudes et de Recherches Aerospatiales (ONERA), 92 - Chatillon (France); Comision Nacional de Energia Atomica, San Carlos de Bariloche (Argentina). Centro Atomico Bariloche). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

56932 (INIS-BR—1229, pp 44) **Electrical resistivity of amorphous Fe/sub 0.92/ Zr/sub 0.08/.** Pureur, P.; Schreiner, W.H.; Kunzler, J.V.; Ryan, D.H.; Coey, J.M.D. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Trinity Coll., Dublin (Ireland)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

56933 (INIS-BR—1229, pp 45) **Electrical resistivity near the critical point in Pd-based Heuler alloys.** Pureur, P.; Kunzler, J.V.; Fraga, G.L.F.; Schreiner, W.H.; Brandao, D.E. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

56934 (INIS-BR—1229, pp 27) **Modifications of the mechanisms of high temperature oxidation of steels by tin ion implantation and radiation enhanced diffusion. part 1. High carbon steel.** Dionisio, P.H.; Baumvol, I.J.R. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

56935 (INIS-SU—36, pp 8-9) **Interaction of helium atoms with tilt large-angle boundary [110] in tungsten.** Bojko, V.S.; Mazilova, T.I. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88780176/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(39).

In Radiation damage physics and radiation material technology. Scientific-technical collection.

Methods of mathematical simulation were applied to study the interaction of helium atoms with symmetric large-angle special boundary of inclination (110) $\Sigma=9$ in bcc lattice of tungsten. Shift and microstress fields in the region of helium atom localization on the boundary are determined. Presence of tensile strains and rapidly decreasing microstresses in the range of boundary adjoint to the interstitial helium atom are found. The analysis of the character of shift and microstress fields testifies to possible initiation of brittle intercrystalline fracture by helium atoms. 9 refs.

56936 (INIS-SU—41, pp 3-8) **Polymorphous transformations in high-dispersion polycrystal structures.** Akhiezer, I.A.; Davydov, L.N.; Chernyaeva, T.P. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780008/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 2(40).

In Radiation-induced damage physics and material technology. Scientific-technical collection.

Thermodynamics of low-temperature polymorphous transformations (occurring at temperatures much lower than melting temperature) is studied. It is taken into account that grain boundary area is retained under such transformations. Theoretical expressions for transition temperature dependence on the degree of the matter dispersion are found. It is shown that in high-dispersion samples under dispersivity growth the transformation temperature should decrease and transformation interval should expand. Experiments on indirect (based on electric resistance measuring) and direct electron microscope observation of martensitic transformation in high-dispersion TiNi are described. Experimental results agree with the theory conclusions. 4 refs.; 4 figs.

56937 (INIS-SU—41, pp 65-76) **Influence of microstructure inhomogeneity and gas impurity of physical-chemical properties of stainless steels.** Platonov, P.A.; Tursunov, I.E.; Levit, V.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780008/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 2(40).

In Radiation-induced damage physics and material technology. Scientific-technical collection.

Investigation into the change of mechanical and physicochemical properies of stainless steel as a result of hydrogen and microstructural inhomogeneity (MI) interaction is conducted. Hydrogen effect on steel samples which have undergone preliminary thermal treatment under different temperatures-from the indoor temperature to 800 deg C one, was evaluated by embrittlement degree, changes in fracture mode and in residual electric resistance (RER), by electron microscope investigation, by outgassing kinetics under linear heating and hydrogen role in intercrystalline corrosion. It is shown that sensibilized stainless steel after thermal ageing at T/sub 0/=650 deg C is subjected to increased hydrogen embrittlement under which fracture mode change from ductile to intercrystalline one occurs. Hydrogen interaction with the grain boundary precipitations without applying external stress leads to formation of stable defects (interfacial microcracks), causing RER anomalous growth. In steel samples aged at T/sub 0/=400 deg C, hydrogen outgassing is moderated. An assumption is made concerning hydrogen outgassing acceleration connection with the increase of hydrogen grain-boundary diffusion part, and hydrogen outgassing slowing down-with its entrapment in microcracks. This assumption is proved by gas release calculations, based on kinetic balance equations. 22 refs.; 12 figs.

56938 (INIS-SU—41, pp 14-19) **Sound effects on kinetics of annealing hydrogen implanted into silicon.** Bakaj, A.S.; Lazarev, N.P. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780008/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 2(40).

In Radiation-induced damage physics and material technology. Scientific-technical collection.

Diffusion of hydrogen implanted into silicon is characterised by peculiarities, connected with high initial hydrogen concentration: at first rapid diffusion occurs through crystal lattice interstices and then, as the mean hydrogen concentration reduces, interaction with dislocations begins to play a notable role, and diffusion slows down. Possible changes in hydrogen behaviour under a strong sound effect on a crystal are investigated. 8 refs.; 1 fig.

56939 (INIS-SU—41, pp 20-26) **Influence of initial structure and stresses on the kinetics of secondary radiation defect accumulation in epitaxial vanadium films.** Zubarev, E.N.; Koz'ma, A.A.; Stetsenko, A.N.; Fedorenko, A.I.; Peregon, T.I.; Tishchenko, L.P. (Khar'kovskij Politekhnicheskij Inst. (Ukrainian SSR); Khar'kovskij Gosudarstvennyj Univ. (Ukrainian SSR)). 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780008/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 2(40).

In Radiation-induced damage physics and material technology. Scientific-technical collection.

Regularities of formation of secondary radiation defects and stresses in epitaxial vanadium films irradiated with He/sup +/ ions and differing in orientation, crystal structure perfection and elastic strains present in them are investigated using precision x-ray diffractometry, electron microscopy and electric resistance methods.

In all the films investigated compressive strains ϵ{similar←to}0.4% are generated under irradiation, after which the secondary defect formation process is suppressed. The effect is linked with increased interstitial atom and vacancy recombination on favourably located defects of dislocation type (introduction loops and edge dislocations). Initial growth of lattice parameter a/sub 0/ in a non-stressed cross section in perfect films is provided by small introduction loops, and its reduction in imperfect samples-by HeV helium-vacancy complex formation. Further growth of a/sub 0/ is conditioned by Frenkel pair recombination stresses, and He/sub m/V/sub n/ (m>n) complex enrichment with helium. 14 refs.; 9 figs.

56940 (INIS-SU—41, pp 29-34) **Comparison of vacancy swelling under pulsed and continuous irradiation.** Koptelov, Eh.A.; Korolev, V.V. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij). 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780008/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 2(40).

In Radiation-induced damage physics and material technology. Scientific-technical collection.

As a result of approximated analytical consideration and exact numerical calculation criterion of differences in vacancy pore growth rate under pulsed and continuous irradiation, equivalent by mean defect generation rate, is obtained which consists in simultaneous compliance with two conditions: 1) vacancy lifetime is sufficiently shorter than irradiation period; 2) point defect recombination during irradiation pulse prevails over defect departure to sinks. During stainless steel irradiation in the basic operation mode of the Moscow meson factory (mean proton flux is 500 μA, frequency is 100 Hz, on-off time ratio is 100) simultaneous performance of these conditions is possible only at temperatures, exceeding the upper swelling temperature. Numerical calculations show, that temperature pulsations with the amplitude of < or approx. 100 deg in the given mode practically produce no effect on vacancy pore growth rate. 11 refs.; 3 figs.

56941 (INIS-SU—41, pp 77-79) **Influence of helium on high-temperature plasticity of molybdenum and niobium.** Ibragimov, Sh.Sh.; Reutov, V.F.; Maksimkin, O.P.; Zhdan, G.D.; Kramar, S.F.; Shigankov, Sh.B. (AN Kazakhskoj SSR, Alma-Ata. Inst. Yadernoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780008/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 2(40).

In Radiation-induced damage physics and material technology. Scientific-technical collection.

Study of helium effect on molybdenum and niobium strength and plasticity characteristics within 600-1200 deg C testing temperature interval is conducted. It is shown, that molybdenum alloying by helium up to 1.2x10/sup -3/ at.% concentration increases its strength and reduces plasticity within the whole range of testing temperatures. Helium effect in niobium (1.6x10/sup -3/ at.%) only manifests itself in the plasticity decrease at 1200 deg C tesing temperature. Electron-microscopic investigations have not confirmed the presence of helium pores either in molybdenum or in niobium in the whole testing temperature range. 4 refs.; 2 figs.

56942 (INIS-SU—41, pp 42-52) **Stimulated polymorphous transformations in metals.** Bakaj, A.S.; Kvachantiradze, G.G. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.; Nauchno-Issledovatel'skij Inst. Stabil'nykh Izotopov, Tbilisi (USSR)). 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780008/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 2(40).

In Radiation-induced damage physics and material technology. Scientific-technical collection.

Possibility of polymorphous modification formation under ion metal alloying is considered. Interfacial boundary and elastic strain field energies are determined in the atom interaction pair model potential approximation. Possibility of stimulated polymorphous transformations in metals under the presence in the system of finely dispersed carbide nuclei is demonstrated. Critical carbon concentrations, necessary for realization of polymorphous transformations, occuring in Nb, are found. A theoretical scheme for determining conditions for the transformation indicated is developed. 24 refs.; 7 figs.; 3 tabs.

56943 (INIS-SU—54, pp 8-11) **Determination of multicriterium model of optimum welding conditions for tube nonrotatory joints.** Chigar'kova, L.K.; Bukarov, V.A.; Dorina, T.A.; Grinenko, V.I. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780013/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2(19).

In Welding in nuclear technology.

The scheme for models of optimum welding condition determination for tube nonrotatory joints is given. On the basis of restrictions, presenting the interrelation equation system of condition parameters with quality criterions for the welded joint, the models of optimum welding conditions for tubes with 33x1.5 m and 33x3.5 m diameters are determined. The determination example for welding condition for 12Kh18M10T steel tubes is presented. 4 refs.; 1 fig.

56944 (INIS-SU—54, pp 12-16) **Two-process approach to electron beam welding control.** Lastovirya, V.N. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780013/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2(19).

In Welding in nuclear technology.

The analysis and synthesis of multi-dimensional welding control systems, which require the usage of computers, should be conducted within the temporal range. From the general control theory point two approaches - one-process and two-process - are possible to electron beam welding. In case of two-process approach, subprocesses of heat source formation and direct metal melting are separated. Two-process approach leads to two-profile control system and provides the complete controlability of electron beam welding within the frameworks of systems with concentrated, as well as, with distributed parameters. Approach choice for the given problem solution is determined, first of all, by stability degree of heat source during welding. 10 refs.; 2 figs.

56945 (INIS-SU—54, pp 16-20) **Measuring and recording system for electron beam welding parameters.** Lobanova, N.G.; Lifshits, M.L.; Efimov, I.I. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780013/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2(19).

In Welding in nuclear technology.

The observation possibility during electron beam welding of circular articles with guaranteed clearance of welding bath leading front in joint gap and flare cloud over the bath by means of television monitor is considered. The composition and operation mode of television measuring system for metric characteristics of flare cloud and altitude of welding bath leading front in the clearance are described. 5 refs.; 5 figs.; 1 tab.

56946 (INIS-SU—54, pp 20-23) **Peculiar features of aluminium alloys welding with electromagnetic stirring.** Shchevelev, L.N.; Vedeneev, I.D.; Suchkov, V.I.; Astaf'ev, N.V.; Butaev, B.M. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780013/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2(19).

In Welding in nuclear technology.

The application perspectives of aluminium alloys in the atomic energy are shown. Peculiarities of argon-arc welding with alternating current for tube of aluminium alloys, which sould be taken in account at welding equipment design, are described. The ways to improve welding quality by means of current programming by the joint, electromagnetic stirring of the bath, automatic feed of welding wire in continuous and pulse mode are shown. 5 refs.; 4 figs.

56947 (INIS-SU—54, pp 28-33) **Heat balance analysis for nonconsumable anode-electrode during welding by stabilized arc.** Poloskov, S.I.; Bukarov, V.A.; Mikheev, S.Yu. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780013/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2(19).

In Welding in nuclear technology.

Heat balance analysis for anode during welding by stabilized arc is conducted. The calculation for heat transfer by liquid and gas

cons coolants is given on the base of Newton-Richman equation solution. It is shown, that the effective regulation of arc efficiency is possible due to the forced convection by gaseous coolant. In this case, the tangential twisting of argon stabilizing flux promotes the increase of heat removal from electrode-anode up to 10-15% of total thermal power. 15 refs; 4 figs.

56948 (INIS-SU—54, pp 33-37) **Possibility of welding control with the use of ion-vapour cloud.** Lobanova, N.G. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780013/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2(19).
In Welding in nuclear technology.

The efficiency of seam formation control systems during electron beam welding (EBW) depends on the correctly chosen feedback signal. Metric characteristics of ion-vapour cloud may be used as such a signal. The connection of ion-vapour cloud geometry observed over the welding zone with fusion zone geometry, established by simplified evaporation model at EBW, leads to that conclusion. 4 refs.; 5 figs.

56949 (INIS-SU—54, pp 37-40) **Possibility of designing television control system for welded joint formation on electron beam welding.** Lifshits, M.L.; Lobanova, N.G. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780013/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2(19).
In Welding in nuclear technology.

Regression equations (models), connecting seam characteristics: width and depth with the welding bath leading front in joint gap and seam width respectively - are obtained at electron beam welding of circular articles with guaranteed clearance with application of television control system. Dispersion analysis showed the models adequancy to the process in the range, where they were identified. 3 refs.; 3 figs.; 2 tabs.

56950 (INIS-SU—54, pp 40-43) **Optical system for electrode guiding to a joint.** Bratchuk, S.D.; Kokhan, I.N.; Anisimov, V.V. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780013/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2(19).
In Welding in nuclear technology.

The design solution for optical system of electrode guiding to a joint on the base of the central vision system, provided with optical visor, placed between the entrance pupil of the optical system and electrode, is suggested. The calculation technique for system retuning during welding of tubes with different diameters is presented. 2 refs.

56951 (INIS-SU—54, pp 43-45) **Choice of mathematical simulation functions for acoustic emission during welded joint cooling.** Paraev, S.A.; Steshits, I.A.; Vasil'ev, V.N. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780013/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2(19).
In Welding in nuclear technology.

The application possibility of mathematical simulation of random processes for description of acoustic emission radiation (AE) during welded joint cooling is shown. Mathematical simulation of AE process allows to decrease the random factors effect at AE parameters registration and to separate useful AE information at noise background. 1 ref.

56952 (INIS-SU—54, pp 46-50) **Increasing lifetime of feed rollers of welding equipment.** Belousov, A.N.; Efanov, V.A. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780013/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2(19).
In Welding in nuclear technology.

The information on lifetime of feed rollers, used in tube-welding automatic and semiautomatic devices, is presented. Device units, limiting the lifetime of the automatic device as a whole, are separated. The ways to improve the lifetime of feed rollers are shown. 3 refs.; 3 tabs.

56953 (INIS-SU—54, pp 3-5) **Formation of σ-phase in weld surfaced austenite-ferrite metal.** Roshchin, V.V.; Muromtsev, B.I.; Ring, I.L. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780013/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2(19).
In Welding in nuclear technology.

Experimental data on the reveal of σ-phase formation in different austenitic-ferritic weld-surfaced metals after provoking thermal treatment in 450-1200/sup d/egC temperature range with time intervals from 2 to 1000 hours are given. The conditions and compositions, accelerating or slowing-down the σ-phase formation in weld-surfaced austenitic-ferritic metal, are presented. 4 refs.

56954 (INIS-SU—54, pp 23-27) **Titanium interaction with chromium and nickel in welded joint of titanium and chromium-nickel alloy.** Gul'bin, V.N.; Nikolaev, V.B.; Roshchin, V.V.; Karpushkina, T.L.; Arkhangel'skaya, O.V.; Polkopina, O.F. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780013/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2(19).
In Welding in nuclear technology.

Transition zone of titanium-chromium-nickel alloy joints before and after different thermal treatment, and diffusion pairs of titanium-nickel, titanium-chromium and nickel-chromium are investigated. It is established, that the heat up to 700-900/sup d/egC leads in Ti-CrNi bimetal by-contact layers to the formation of five zones, where are formed the solution of nickel and chromium in titanium, the solution of chromium in Ti/sub 2/Ni chemical compound, the solution of nickel in TiCr/sub 2/ compound, finely disperse mixture and solid solution on chromiumbase. The boundaries for phases, forming in joints are established at isothermal cross-section of equilibrium state diagram for titanium-nickel-chromium system. It is established by studying of elements interaction kinetics, that diffusion zones growth is obeyed to the parabolic law. 4 refs.; 5 figs.; 2 tabs.

56955 (INIS-SU—54, pp 6-8) **Structure and stress effects on corrosion cracking of welded joints.** Zakharov, Yu.V.; Fedyakin, P.N. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780013/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; no. 2(19).
In Welding in nuclear technology.

The investigation results on differences determination in tendency of 12Kh18N10T and 40Kh steels to corrosion cracking at the samples, simulating HAZ metal structure, are presented. It is shown, that HAZ metal with high relaxation resistance in the corrosive medium is more subjected to corrosion cracking. 9 refs.; 4 figs.

56956 **(INIS-SU—54) Welding in nuclear technology.** (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow). 1987. 58p.

Individual papers are processed separately.

56957 **(Juel—2191) Radiation induced impurity transport in dilute gold, copper and silver alloys.** Vaessen, P. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung; Technische Hochschule Aachen (Germany, F.R.)). Mar 1988. 138p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755291/JAW.

The present thesis investigates the interstitial-impurity interaction in dilute alloys. Thus the kinetics of the radiation-induced segregation of the impurities is observed by means of electric conductivity measurements. By proton irradiation a great deal of free interstitials is produced and by Helium implantation many traps which are stable during proton irradiation are built in. This new measuring method is applied to the systems AuFe, AuNi, AuPt, AuTi, CuSi, AgAl, AgGe, AuMn, AuV, AuZn, CuNi, AgMn, AgPd, AuAl, AgAu and AgZn. (BHO).

56958 (Juel—2192) Studies of the manufacturing of OFHC grade 1 copper for accelerator cavities. Haas, H.; Delis, K.; Wolf, W.; Watermeyer, K. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralabteilung Allgemeine Technologie). Mar 1988. 63p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755178/JAW.

Accelerator cavities are manufactured by preference out of very pure copper. The OFHC-quality according to ASTM standard B170, grade 1, with additional specifications has been selected in order to meet the requirements for the working, manufacturing and service of the cavity. Starting with ingots made by continuous casting forgings, plates, sheets, rings and tubes have to be worked out in a first step. In a second step these parts have to be machined and welded together. The procedures of these two steps have been tested on real shapes. As a result of these tests it has been demonstrated that the produced parts conform to the requirements. In addition the effects of varying production parameters could be shown.

56959 (KAPL—4197) A crack extension limit for fracture instability data. Macdonald, B.D. (Knolls Atomic Power Lab., Schenectady, NY (USA)). Nov 1987. Contract AC12-76SN00052. 11p. NTIS, PC A03/MF A01. Order Number DE89000631/JAW.

Fracture instability data, with and without significant stable crack extension, and J/sub IC/ tearing-onset data were studied to find a crack extension limit for the fracture instability data from low alloy steels. New A508-Class 2 data were used to identify both tearing onset (valid J/sub IC/ and fracture instability response curves (fracture toughness was well below J/sub IC/. A fracture instability value of J was considered qualified as a fracture toughness parameter provided that the crack extension at instability was less than or equal to 0.15 mm. Data with greater crack extension were shown to be tearing onset data even if the specimen failed by fracture instability. Thinner-than-standard specimens were found more likely to provide tearing onset data than were standard thickness specimens. 6 refs., 6 figs.

56960 (KY/L—1509) Alternate alloys for UF_6 cylinder valve packing nuts. Blue, S.C. (Paducah Gaseous Diffusion Plant, KY (USA)). Sep 1988. Contract AC05-84OT21400. 14p. NTIS, PC A03/MF A01. Order Number DE89001066/JAW.

One-inch cylinder valve packing nuts made from aluminum bronze alloy C63600 are susceptible to stress corrosion cracking. The use of alloys which are more resistant to cracking should eliminate the occasional nut failures. It is proposed that packing nuts be produced from either aluminum bronze C61300 or Monel (NO4400). 2 refs., 4 tabs.

56961 (LA-UR—88-3055) Surface electronic behavior of actinide materials. Hao, Y.G.; Fernando, G.W.; Cooper, B.R. (Los Alamos National Lab., NM (USA); West Virginia Univ.; Morgantown (USA). Dept. of Physics; Brookhaven National Lab., Upton, NY (USA)). 1988. Contract W-7405-ENG-36. 26p. (CONF-881002—7). NTIS, PC A03/MF A01. Order Number DE89000354/JAW.

From 35. national vacuum symposium and 4th international laser science conference; Atlanta, GA, USA (2 Oct 1988).

The self-consistent Film Linearized Muffin-Tin (FLMTO) method has been used to calculate the surface electronic structure of plutonium. This has been done using a (111)-oriented five-layer slab geometry. We use the full potential in the interstitial and vacuum, while the Non-Muffin-Tin (NMT) potential in the spheres is approximated by the extended interstitial NMT potential. The calculated work function of plutonium is strongly affected by the treatment of the 6p electrons, and with spin-orbit coupling effects included is 4.3 eV with 6p electrons treated as core, in good agreement with experimental values of 3.4-4.3 eV for uranium. A much higher calculated value of 8.4 eV if the 6p electrons are treated as valence electrons, shows that the 6p electrons are largely localized. The narrow band width of the 5f electrons and the position relative to s and d bands relate to the intermediate delocalization of the 5f electrons and the existence of hybridization with the s and d electrons. 17 refs., 6 figs.

56962 (NUREG/CR—5024) Tensile and J-R curve characterization of thermally aged cast stainless steels. Hiser, A.L. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Materials Engineering Associates, Inc., Lanham, MD (USA)). Sep 1988. 206p. (MEA—2229). NTIS, PC A10/MF A01 - GPO. Order Number TI89001179/JAW..

Although cast stainless steels have excellent properties in the as- received or pre-service condition, significant degradation of the properties, principally fracture toughness (J-R curve), can occur after extended exposure to elevated temperatures typical of service conditions. The NRC is sponsoring work to study the significance of in-service embrittlement of thermally aged, cast stainless steel. This report summarizes the results of tensile and J-R curve tests of commercial and experimental heats of these steels. The materials were supplied by Argonne National Laboratory (ANL), who have conducted microstructural studies to identify the degradation mechanisms. The loss in Charpy-V upper shelf energy can be quite large, up to 57% for aging at 450{degree}C for 9980 h. The decrease in fracture toughness, specifically J levels on the J-R curve, can be even more severe, with a reduction of 75%, in some cases. Data from this study are accessible through the NRC's Piping Fracture Mechanics Data Base (PIFRAC), an on-line system available at MEA. 26 refs., 121 figs., 30 tabs.

56963 (PNL/SRP—6637) Statistical evaluation of unobserved nonuniform corrosion in A216 steel. Pulsipher, B.A. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1988. Contract AC06-76RL01830. 21p. NTIS, PC A03/MF A01. Order Number DE89001010/JAW.

Tests designed to promote nonuniform corrosion have been conducted at PNL on A216 steel. In all of the tests performed to date, there have been no manifestations of significant nonuniform corrosion. Although this may suggest that nonuniform corrosion in A216 steel may not be a significant problem in the nuclear waste repository, a question arises as to whether enough tests have been conducted for a sufficient length of time to rule out nonuniform corrosion of A216 steel. In this report, a method for determining the required number of tests is examined for two of the mechanisms of nonuniform corrosion: pitting and crevice corrosion.

56964 (SAND—88-1351) Mechanical properties of dispersion strengthened copper: A comparison of braze cycle annealed and coarse grain microstructures. Stephens, J.J.; Bourcier, R.J.; Vigil, F.J.; Schmale, D.T. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1988. Contract AC04-76DP00789. 58p. NTIS, PC A04/MF A01. Order Number DE89001061/JAW.

The tensile properties of a commercial oxide dispersion strengthened copper alloy (Glidcop A1-15, Low Oxygen Grade) have been studied at both room temperature and elevated temperatures in various microstructural conditions. The alloy has been examined in various fine grained conditions with highly elongated grains and substantial amount of cold work, as well as a coarse grained condition obtained using secondary recrystallization. The fine grained specimen conditions included the as-extruded condition, a thermal cycle of 5 minutes at 980{degree}C, appropriate for a simulated Ti-Cu-Ni braze cycle, and an extended Ti-Cu-Ni braze thermal cycle of 15 minutes at 980{degree}C. The coarse grained condition was obtained by a long term anneal, i.e., 100 hrs at 1040{degree}C. The results for room temperature tests indicated that the two braze thermal cycles had only a small effect on both yield and tensile strength, but did realize small increases in ductility, compared to the as-extruded condition. However, the coarse-grained condition exhibited significant decreases in both yield and tensile strength, along with a large increase in ductility. Both optical metallography and scanning electron microscopy were used in order to understand the changes observed in strain to fracture and fracture mode at the various temperatures. The room temperature fracture surfaces all exhibited classic ductile rupture with dimpled fracture surfaces. The fracture surfaces at higher temperatures and slower strain rates exhibited an increased tendency to fracture with some grain boundary void formation. 25 refs., 25 figs., 6 tabs.

56965 **(STF—16A86153) Effects of cathodic protection on corrosion fatigue crack growth in a platform steel in sea water.** Berdal, E.; Haagensen, P.; Groevlen, M.; Saether, F. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Dec 1986. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754898/JAW.

Crack growth rates have been determined under free corrosion and cathodic protection (CP). Retarding and accelerating effects of CP on crack growth rates at different growth level are shown. The total effects of CP on crack growth life under different conditions are determined by integrating crack growth data from constant load amplitude tests, applying a linear load spectrum in the integration. When only small defects (1 mm) and long life (>20 years) are assumed, CP increases the life up to one order of magnitude. On the other hand, under the most unfavourable conditions of CP from sacrificial anodes and high growth rates, crack growth life may be slightly reduced compared with the life under free corrosion conditions. 11 drawings.

56966 **(SVF—303) Corrosion in condensing flue gas. Plant study phase I and II.** Pourbaix, M. de. (Studsvik Energiteknik AB, Nykoeping (SE)). (Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden); Studsvik Energiteknik AB, Nykoeping (Sweden)). Apr 1988. 57p. (In Swedish). (STUDSVIK-EX—87-52). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755114/JAW.

The scope of these tests was to evaluate the applicability of the proposed corrosion testing technique for heat-exchange tubes and to determine the corrosion rates of some alloys in condensing flue gas. The alloys tested were carbon steel, four stainless steels, one nickel base alloy and titanium. Under the testing conditions very small amounts of condensate was formed on the specimens resulting in low corrosion rates. Ranging of the alloys due to corrosion resistance was rather difficult. Carbon steel showed general corrosion attack and stainless steels showed local pitting. The nickel-base alloy Hastelloy C-276 and titanium were unattacked.

56967 **(SVF—304) Inhibitors for hot water and boiler systems.** Falk, I. (Studsvik Energiteknik AB, Nykoeping (SE)). (Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden); Studsvik Energiteknik AB, Nykoeping (Sweden)). Apr 1988. 53p. (In Swedish). (STUDSVIK-NS—88-283). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755115/JAW.

Experimental tests have been carried out to study the effect of chemical additives on the formation of oxide layers on copper and carbon steel. The tests with plate specimens were run for 14 days in an autoclave system supplied with a continuous flow of deionised and softened water. The oxygen content was held at <5, 100 or 500 ppb O/sub 2/. The temperature was 150 or 250 degrees C. The specimens have been evaluated by visual inspection of the oxide layer and by measurements of the weight changes and metal losses. In the studies the following additives had been used: Ivamin 802, Transport Plus 7200, Eliminox, Amersite 70, R88 and Ivamol 401. For reference, tests have been carried out with hydrazin, and water alone, at 150 degrees C. In softened water at 250 degrees C and <5 ppb oxygen in the presence of Ivamin 802 or Transport Plus 7200 a discontinuous oxide layer is obtained, which cannot protect the metal from corrosion attack. The results show that these additives can only protect the metal to a limited extent in softened water. Tests with additives in softened water at 150 degrees C and 500 ppb oxygen showed worse results than hydrazine throughout. The testing environment has been somewhat accelerated but completely comparable with normal operational conditions. This is clear from the fact that the metal losses in water are reduced by 91% when hydrazin is added. The oxygen reducing additives showed an inhibition effect of 54-79% of that obtained for hydrazin. Ivamin 802 had no protective effect. The copper specimens had a weight loss which was almost the same for the reference specimen and additions of Amersite 70, R88 and Ivamol 401. The weight losses when Eliminox and hydrazin were added were much less.

56968 **(UCRL—53884) An analysis of materials selected for mocking high-strain-rate mechanical behavior of uranium alloys.** Rosen, R.S.; Oldani, J.J.; Kassner, M.E. (Lawrence Livermore National Lab., CA (USA)). 15 Sep 1988. Contract W-7405-ENG-48. 13p. NTIS, PC A03/MF A01. Order Number DE89000489/JAW.

We studied the mechanical behavior of U-6Nb and compared it with the behavior of AISI 1215 and AISI 1045 steels. We performed conventional tensile tests at varying strain rates and Hopkinson split-bar dynamic compressive tests to determine flow stress as a function of strain rate. We also performed Charpy V-notch impact tests to measure absorbed fracture energy. We used regression analysis to calculate a constitutive equation, flow stress evaluated at constant plastic strain, and D and p are strain-rate sensitivity constants for each of the three materials. This equation relates flow stress to strain rate up to very high strain rates. Our extrapolation for uranium and the constitutive equation for AISI 1045 both agree closely with data from the literature. Our findings indicate that AISI 1045 and U-6Nb exhibit comparable stress-strain and fracture behavior but that AISI 1215 fractures at lower stress levels and absorbs much less energy during fracture than does U-6Nb. We also evaluated the mechanical behavior of tantalum, which has Hugoniot properties comparable to those of uranium, and found that the strain-rate sensitivity, fracture energy, and ductility are all much more pronounced for tantalum than for uranium. 7 refs., 10 figs., 2 tabs.

56969 **(UCRL—98584) Mechanically-induced phase transformations in plutonium alloys.** Wallace, P.L.; Wien, W.L.; Goehner, R.P. (Lawrence Livermore National Lab., CA (USA); Nicolet Instrument Corp., Madison, WI (USA)). 1 Aug 1988. Contract W-7405-ENG-48. 8p. (CONF-8808126—1). NTIS, PC A02/MF A01. Order Number DE88017014/JAW.

From 37. annual applications of analysis x-ray conference; Steamboat Springs, CO, USA (1 Aug 1988).

In this article, we show that mechanically-induced phase transformations can be readily achieved in two Pu-alloy systems. We have observed mechanically-induced phase transformations in both Ti-stabilized β-Pu and Ga-stabilized δ-Pu. In both of these alloys, the parent phase has been largely transformed to α-Pu, and the cause of these transformations was mechanical strain introduced by the metallographic sample preparation. For the Ga alloys, x-ray diffraction (XRD) patterns were taken at about 1.5-μm steps down to the undisturbed material in order to develop depth profiles of the surface damage. The proportions of α-Pu and δ-Pu in the Ga alloys have been estimated using (a) a new quantitative phase analysis program (SPECQUAN) that uses multiple peaks of each phase in order to minimize the effects of preferred orientation and (b) an older manual technique (i.e., hand calculations). The results from these techniques are compared. SPECQUAN was developed to use the SPECPLOT data file structure directly, thus reducing our data processing. The program is written in Fortran 77 and employs an external intensity ratio quantification procedure to obtain its results. XRD calibration has been done independently by means of accurate density measurements on a reference Ga alloy. 12 refs., 5 figs., 2 tabs.

56970 **Hydrogen-induced crystal to glass transformation in Zr_3Al.** Meng, W.J.; Okamoto, P.R.; Thompson, L.J.; Kestel, B.J.; Rehn, L.E. (Materials Science Division, Argonne National Laboratory, Argonne, Illinois 60439). *Applied Physics Letters;* **53**: No. 19, 1820-1822(7 Nov 1988).

The process of hydrogen-induced amorphization of the equilibrium intermetallic compound Zr_3Al is compared to ion-irradiation-induced amorphization of the same compound. In contrast to ion irradiation, where almost complete chemical disordering precedes the onset of amorphization, hydrogenation of Zr_3Al causes no appreciable change in long-range order prior to amorphization. Electron microscopy reveals apparent homogeneous nucleation of the amorphous phase, and striking similarities to martensitic microstructures. The maximum lattice dilation observed prior to amorphization by hydrogen absorption is identical to that found during irradiation, indicating that lattice expansion is a common measure of the crystal instability induced by different solid-state processing techniques.

56971 **Post cathode magnetron sputter deposition inside a long, small-diameter closed-end tube.** Peeples, C.R.; Cuthrell, R.E.; Mattox, D.M. (Surface and Interface Technology Division -1834, Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* **6**: No. 6, 3159-3160(Nov 1988).

We have demonstrated the possibility of depositing thick molybdenum films closed-end insulating tube using the post cathode magnetron sputter deposi tion configuration using a high sputtering gas pressure an a means for rem oving the surface charge buildup. (AIP)

56972 **Diffuse scattering from the icosahedral phase alloys.** Goldman, A.I.; Guryan, C.A.; Stephens, P.W.; Parsey J.M. Jr.; Aeppli, G.; Chen, H.S.; Gayle, F.W. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review Letters;* **61**: No. 17, 1962-1965(24 Oct 1988).

We present neutron and x-ray measurements of the diffuse scattering from single-grain samples of the icosahedral phase of Al-Li-Cu. The x-ray measurements were analyzed to determine the integrated intensity of the diffuse scattering relative to the sharp diffraction peaks, as well as the length scale of the correlations which produce the diffuse scattering. The neutron data show that these correlations are static rather than dynamic in nature. In addition, we present a simple model based on the disordered packing of icosahedral clusters of atoms, such as that proposed by the icosahedral glass description which reproduces the unusual ringlike nature of this scattering. Quantitatively, this model overestimates the degree of disorder present in these alloys.

56973 **Calculation of phonons on the Cu(100) surface by the embedded-atom method.** Nelson, J.S.; Sowa, E.C.; Daw, M.S. (Sandia National Laboratories, Livermore, California 94550). *Physical Review Letters;* **61**: No. 17, 1977-1980(24 Oct 1988).

We present here calculations, based on the embedded atom method, of phonon energies and polarizations on the clean Cu (100) surface. The atomic relaxations and the dynamical matrix are obtained, without fitting to surface properties, in one consistent calculation which is no more computationally demanding than pair potentials. Excellent agreement with experiment is obtained. We find that the force constants are qualitatively different than those obtained by fitting two-body central-potential models, reflecting the many-body nature of the calculation and suggesting that fits based on central-potential models may be misleading.

56974 **Nucleated and continuous ordering in Cu_3Au.** Ludwig K.F. Jr.; Stephenson, G.B.; Jordan-Sweet, J.L.; Mainville, J.; Yang, Y.S.; Sutton, M. (IBM Research Division, Thomas J. Watson Research Center, Yorktown Heights, New York 10598). *Physical Review Letters;* **61**: No. 16, 1859-1862(17 Oct 1988).

The early-stage ordering kinetics in Cu_3Au has been investigated by in situ time-resolved x-ray scattering. At temperatures above the first-order transition point, T/sub tr/, short-range order fluctuations reeequilibrate in a few seconds after a quench from high temperature. At temperatures just below T/sub tr/ the fluctuations relax to a metastable state which then decays by relatively slow nucleation and growth. At lower temperatures, the time scales of the two processes become similar. The ordering becomes continuous well above the classical spinodal temperature.

56975 **Nonlinear dc conductivity in disordered metals near the metal-insulator transition.** Osofsky, M.; LaMadrid, M.; Bieri, J.B.; Contrata, W.; Gavilano, J.; Mochel, J.M. (Material Research Laboratory and Department of Physics, University of Illinois at Urbana-Champaign, 1110 West Green Street, Urbana, Illinois 61801). *Physical Review [Section] B: Condensed Matter;* **38**: No. 12, 8486-8489(15 Oct 1988).

A detailed study of the nonlinear dc conductivity of two disordered alloys, Ge/sub x/Au/sub 1-//sub x/ and C/sub x/Cu/sub 1-//sub x/, is carried out near their metal-insulator transition for electric fields up to 500 V/m at 1.3 K $<T<$4.2 K and, for C/sub x/Cu/sub 1-//sub x/, down to 15 mK. Analysis of the σ(E) data in the context of an electron-gas-heating model yields unexpectedly long electron-phonon relaxation times. Above 1 K the hot-electron model is not sufficient to explain these results. We propose that the electric field also acts directly on the localizing electrons, which leads to an E/sup 1/3/ dependence of the conductivity.

56976 **(K/TR—88-4) A manufacturing process for alloys of rare-earth metals and the system used in this manufacturing process.** Yamanaka, Toshio. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 1988. Contract AC05-84OT21400. Translation of Japanese Patent 49-79314, July 31, 1974. 11p. NTIS, PC A03/MF A01. Order Number DE89001025/JAW.

The present invention concerns a process by which a dissolved-salt bath containing rare-earth metals, alkali metals and the fluorides of alkaline-earth metals, is used to manufacture alloys of rare-earth metals and metals that have a melting point and a specific weight lower than those of the dissolved-salt bath, and the system used to carry out this process.

56977 **Copper modified austenitic stainless steel alloys with improved high temperature creep resistance.** Swindeman, R.W.; Maziasz, P.J. US Patent Application 6-043,775. 28 Apr 1987. 11p. Contract AC05-84OR21400. NTIS, PC A03/MF A01.

An improved austenitic stainless steel that incorporates copper into a base Fe-Ni-Cr alloy having minor alloying substituents of Mo, Mn, Si, T, Nb, V, C, N, P, B which exhibits significant improvement in high temperature creep resistance over previous steels. 3 figs.

56978 **Radiation resistant austenitic stainless steel alloys.** Maziasz, P.J.; Braski, D.N.; Rowcliffe, A.F. US Patent Application 6-013,471. 11 Feb 1987. 17p. Contract AC05-84OR21400. NTIS, PC A03/MF A01.

An austenitic stainless steel alloy, with improved resistance to radiation-induced swelling and helium embrittlement, and improved resistance to thermal creep at high temperatures, consisting essentially of, by weight percent: from 16 to 18% nickel; from 13 to 17% chromium; from 2 to 3% molybdenum; from 1.5 to 2.5% manganese; from 0.01 to 0.5% silicon; from 0.2 to 0.4% titanium; from 0.1 to 0.2% niobium; from 0.1 to 0.6% vanadium; from 0.06 to 0.12% carbon; from 0.01 to 0.03% nitrogen; from 0.03 to 0.08% phosphorus; from 0.005 to 0.01% boron; and the balance iron, and wherein the alloy may be thermomechanically treated to enhance physical and mechanical properties. 4 figs.

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REFER ALSO TO CITATION(S) 56199, 56905, 57101, 57248

56979 **(AD-A—194958/5/XAB) Boron nitride and its precursors. Technical report.** Paciorek, K.J.; Krone-Schmidt, W.; Harris, D.H.; Kratzer, R.H. (Ultrasystems Defense and Space Systems, Inc., Irvine, CA (USA)). 24 Aug 1987. 17p. (TR—6). NTIS, PC A03/MF A01.

Formation of preceramic polymers by stepwise pyrolysis of borazines was found to be strongly dependent upon the ring substituents. Boron nitride fibers were obtained via preceramic polymers produced from B-triaminio-N-tris(trimethylsilyl)borazine. Studies were carried out to determine the suitability of linear boron-nitrogen composition as preceramic polymer precursors. The mechanisms responsible for the observed results are delineated.

56980 **(AD-A—195109/4/XAB) New highly conducting systems. Technical report.** Keller, H.J.; Bandrauk, A.D.; Bayon, J.C.; Bellito, C.; Clark, R.J. (North Carolina Univ., Chapel Hill (USA). Dept. of Chemistry). 1987. 9p. (TR—31). NTIS, PC A02/MF A01.

Pub. in Organic and Inorganic Crystalline Materials, 457-461(1987).

Crystalline inorganic and organic solids with the potential for high electrical conductivity in one or two dimensions are dis-

cussed. These include all crystalline materials which have metal-like behavior, especially if they indicate the possibility of superconductivity. The materials include classical inorganics such as metal oxides, sulfides, selenides, or halides; coordination compounds of metal ions with mainly organic ligands such as metal dithiolates, or phthalocyaninates; and solids comprised of organic ions responsible for the conduction path.

56981 (AD-A—195423/9/XAB) Far-infrared measurement of α 2(omega)F(omega) in superconducting La(1.84)Sr(0.16)CuO(4-y). Sulewski, P.E.; Sievers, A.J.; Buhrman, R.A.; Tarascon, J.M.; Greene, L.H. (Cornell Univ., Ithaca, NY (USA)). 1 Jun 1987. 5p. NTIS, PC A02/MF A01.

Pub. in Physical Review B, Vol. 35, No. 16, 8829-8832(1 Jun 1987).

A Measurement of the far-infrared surface resistance for La-Sr-Cu oxide both above and below the superconducting transition temperature has been used to obtain the frequency dependence of alpha squared omega F omega in the superconducting state. The dominant feature in the spectrum is a single elastic or quasi-elastic peak near the gap energy.

56982 (BNL—41622) Synthesis, structure, and properties of $A_2B_2Ca_n$ {minus}1/Cu/sub n/O/sub 2n{plus}4/ superconductors (A/B = Bi/Sr or Tl/Ba, and n = 1, 3, 3). Torardi, C.C.; Subramanian, M.A.; Gopalakrishnan, J.; McCarron, E.M.; Calabrese, J.C.; Morrissey, K.J.; Askew, T.R.; Flippen, R.B.; Chowdhry, U.; Sleight, A.W.; Cox, D.E. (Brookhaven National Lab., Upton, NY (USA); Du Pont de Nemours (E.I.) and Co., Wilmington, DE (USA). Central Research and Development Dept.). 1988. Contract AC02-76CH00016. 16p. (CONF-880431—5). NTIS, PC A03/MF A01. Order Number DE88016580/JAW.

From International conference on the first two years of high-{Tc} superconductivity; Tuscaloosa, AL, USA (11 Apr 1988).

There is now a new series of high temperature superconducting oxides that may be represented as $A_2B_2Ca_n$ {minus}1/Cu/sub n/O/sub 2n+4/ where A/B = Bi/Sr or Tl/Ba, and n, the number of CuO_2 sheets stacked consecutively in the structure, equals 1, 2, or 3. There is a general trend toward higher superconducting transition temperatures as n increases. The preoperative conditions, superconducting properties, and structures of these compounds are discussed. 12 refs., 3 figs., 2 tabs.

56983 (BNL—41737) High T/sub c/ superconductors from metallorganic precursors. Wang, Y.L.; Chou, W.T.; Skotheim, T.; Budhani, R.; Suenaga, M.; Okamoto, Y. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 6p. (CONF-880669—21). NTIS, PC A02/MF A01. Order Number DE89001090/JAW.

From International conference on science and technology of synthetic metals; Santa Fe, NM, USA (26 Jun 1988).

High T/sub c/ cuprate superconductors have been made by pyrolysis of metallorganic precursors (polyacrylic acid and acetates) incorporating the appropriate molar ratios of metal ions to form the desired copper oxide compounds. Two processes have been described as representative examples of novel strategies to produce high T/sub c/ superconductors in bulk and thin film form: pyrolysis of metallorganic powders for bulk processing and spray pyrolysis for thin film fabrication. 2 refs., 4 figs.

56984 (BNL—41783) Preparation and some properties of H/sub x/$REBa_2Cu_3O_7$ (RE = Er, Nd, Dy, Ho, Gd) superconductors. Johnson, J.; Suenaga, M.; Thompson, P.; Reilly, J. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 6p. (CONF-880969—4). NTIS, PC A02/MF A01. Order Number DE89002178/JAW.

From Metal hydrogen systems fundamentals and applications conference; Stuttgart, F.R. Germany (4 Sep 1988).

Hydrogen gas has been found to react directly with the subject oxides. Most exhibit a small region of H solid solubility which remains superconducting with a slight increase in critical temperature (1 to 2K). At higher H contents a hydrogen rich hydride phase precipitates which is amorphous. The H rich phases are not superconducting at 4K or above. Neutron diffraction studies of D/sub 1.55/$YBa_2Cu_3O_7$ confirm that the D rich phase is amorphous but that its precipitation causes increased microtwinning in the D saturated oxide. 12 refs., 3 figs.

56985 (CONF-880207—7) Critical fields and characteristic lengths in copper oxide superconductors. Crabtree, G.W.; Kwok, W.K.; Umezawa, A. (Argonne National Lab., IL (USA)). Feb 1988. Contract W-31109-ENG-38. 14p. NTIS, PC A03/MF A01. Order Number DE89000543/JAW.

From Discussion meeting on high-{Tc} superconductors; Mauterndorf, Austria (7 Feb 1988).

There have been a number of studies of the critical fields and critical currents in the two copper oxide superconducting families La/sub 2-x/Sr/sub x/CuO_4 and YBa_2Cu_3O/sub 7- δ/ which show unexpected and unusual properties. Resistive measurements of the superconducting transition in zero and finite field often show long tails extending to low temperatures, and the critical field curves constructed from such data often show unusual upward curvature, especially near T/sub c/. Initially most of the critical field studies were done on polycrystalline sintered samples. With such samples there is always a lingering question as to whether the measured properties are intrinsic to the material or are due to poor connections between particles or to the averaging of strongly anisotropic behavior over many crystallites orientations. We characterize the typical behavior of polycrystalline samples and compare it to results on single crystals. Much of the behavior seen in polycrystals also appears in single crystals and that among single crystal samples there is significant sample dependence. We combine information with new measurements of the lower critical field at low temperature to derive the anisotropic magnetic penetration depth. Finally, we compare the derived characteristic length with relevant unit cell dimensions and with the scale of the microstructure to infer information about the dimensionality of the superconductivity and the pinning forces in YBa_2Cu_3O/sub 7-δ/. 26 refs., 9 figs., 1 tab.

56986 (CONF-880715—9) Magnetic field penetration into the high temperature superconductor YBa_2Cu_3O/sub 7{minus}x/. Mansour, A.; Hilleke, R.O.; Felcher, G.P.; Laibowitz, R.B.; Chaudhari, P.; Parkin, S.S.P. (Argonne National Lab., IL (USA)). Jul 1988. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01. Order Number DE89000547/JAW.

From 4. international conference on neutron scattering (ICNS '88); Grenoble, France (12 Jul 1988).

The penetration depth of a magnetic field into a superconducting YBa_2Cu_3O/sub 7-x/ film was measured by polarized neutron reflection. The sample comprised an epitaxial film with the c-axis of its orthorhombic structure perpendicular to the film's surface. Measurements at 14 K showed that a magnetic field (parallel to the surface) penetrates into the surface over a depth of 1400 {angstrom}. 9 refs., 3 figs.

56987 (CONF-880914—5) Superconducting wires. Lanagan, M.T.; Poeppel, R.B.; Singh, J.P.; Dos Santos, D.I.; Lumpp, J.K.; Dusek, J.T.; Goretta, K.C. (Argonne National Lab., IL (USA)). Jun 1988. Contract W-31109-ENG-38. 14p. NTIS, PC A03/MF A01. Order Number DE89000623/JAW.

From 18. rare earth research conference; Lake Geneva, WI, USA (11 Sep 1988).

The requirement of high critical current density has prompted extensive research on ceramic processing of high-T/sub c/ superconductors. An overview of wire fabrication techniques and the limitations they impose on component design will be presented. The effects of processing on microstructure and critical current density will also be discussed. Particle alignment has been observed in extruded samples which is attributed to high shear stresses during plastic forming. Composites of superconductor and silver in several configurations have been made with little deleterious effect on the superconducting properties. 35 refs., 2 figs., 1 tab.

56988 (CONF-8806244—1) Sulfide capacities of CaO-FeO-SiO_2 slags. Chen, B.; Reddy, R.G.; Blander, M. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01. Order Number DE89000533/JAW.

From 3. international conference on molten slags and fluxes; Glasgow, UK (27 Jun 1988).

A number of empirical correlations have been proposed between sulfide capacity and basicity of slags. Recently, we showed that sulfide capacities of some binary silicate slags could not be predicted a priori, based in the concept of optical basicity, and we presented a new and simple fundamental solution model for making such predictions, based on polymer theory. In this paper we discuss predictions of the sulfide capacities of $CaO-FeO-SiO_2$ slags at 1773 K, based on our model. 8 refs., 2 figs., 1 tab.

56989 **(EGG-M—88135) Ultrasonic detection of voids in ceramic composites.** Walter, J.B.; Lott, L.A. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 6p. (CONF-880760—4). NTIS, PC A02/MF A01. Order Number DE88016952/JAW.

From Review of progress in quantitative nondestructive evaluation; La Jolla, CA, USA (31 Jul 1988).

The particular material under study consists of a Nicalon fiber weave reinforcing fabric in a silicon carbide matrix formed by a chemical infiltration process. The process can result in high porosity and voids because of incomplete infiltration by the SiC-containing vapor. The basic objective of this NDE study is detection and characterization of the porosity and voids. Previous work established correlations between ultrasonic attenuation and velocity and material porosity. The material was found to be highly attenuating, particularly at high frequencies, which limits useful measurements to those made by through-transmission techniques at frequencies of {approximately}5 MHz or less, depending on sample thickness and porosity. Thermoelastic generation of ultrasound by a pulsed laser beam was found to have advantages over insonification by conventional piezoelectric transducers because of more direct coupling of ultrasound into the material and because of the higher energy available with the laser. The ability of ultrasonics to image variations in the distribution of porosity in samples was also demonstrated. 3 refs., 4 figs.

56990 (INIS-BR—1229, pp 8) **Spin reorientation phenomena in Er/sub 1-x/Gd/sub x2/Fe/sub 14/B alloys.** Vasquez, A.; Sanchez, J.P. (Rio Grande do Sul Univ., Porto Alegre (Brazil); Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

56991 (INIS-BR—1229, pp 6) **Spin reorientation phenomena in RE/sub 2/Fe/sub 14/B (RE = Ce,Dy,Er) alloys from /sup 57/Fe and /sup 161/Dy Moessbauer spectroscopies.** Vasquez, A.; Friedt, J.M.; Sanchez, J.P.; L'Heritier, P.; Fruchart, R. (Rio Grande do Sul Univ., Porto Alegre (Brazil); Strasbourg - 1 Univ., 67 (France). Centro de Recherches Nucleaires). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

56992 (INIS-SU—36, pp 72-74) **Neutron-diffraction study on zirconium hydrides irradiated in nuclear reactor channel.** Mandzhavidze, A.G.; Fedorov, V.M.; Gogava, V.V.; Shilo, S.I. (AN Gruzinskoj SSR, Tbilisi. Inst. Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88780176/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(39).

In Radiation damage physics and radiation material technology. Scientific-technical collection.

Neutron-diffraction investigation of Zr/sub 1.75/ and Zr/sub 1/./sub 98/ hydrides, irradiated in nuclear reactor channel by 9X10/sup 17/ neutr./cm/sup 2/ fluence at about 150 deg C was conducted. Redistribution of intensities of (111) and (200) refleces and occurrence of diffusion background, asymmetric with respect to diffraction (111) peak were revealed on neutron diffraction patterns of irradiated Zr/sub 1.75/ hydride. All this is related with occurrence of concentration heterogeneities in irradiated hydride. Annealing at 200 deg C restores the initial distribution of hydrogen atom concentration in sample volume. 10 refs.; 2 figs.; 2 tabs.

56993 (INIS-SU—46, pp 39-41) **Properties of films and coatings based on lanthanum and yttrium ceramics.** Golovashkin, A.I.; Krasnosvobodtsev, S.I.; Pechen', E.V.; Rodin, V.V. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780179/JAW.

Kratkie Soobshcheniya po Fizike.; (no.9).

In Experimental and theoretical physics. Collection.

The method of laser sputtering is used to prepare La-Sr-Cu-O and Y-Ba-Cu-O films with the start of transition into a superconducting state at 40 and 100 deg K. Coatings and whiskers with 70 and 92 deg K critical temperatures are prepared. Comparative structural analysis of films, coatings and bulk specimens is made. 3 refs.; 3 figs.

56994 **(LBL—25842) Bi-Ca-Sr-Cu-O superconductors: The connectivity issue.** Ramesh, R.; Thomas, G.; Green, S.M.; Jiang, C.; Mei, Y.; Luo, H.L. (Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC03-76SF00098. 16p. (CONF-880812—7). NTIS, PC A03/MF A01. Order Number DE89000558/JAW.

From Applied superconductivity conference; San Francisco, CA, USA (21 Aug 1988).

The connectivity problem in Bi-Ca-Sr-Cu-O superconductors is addressed in this paper. Our bulk samples always exhibit a step in the resistivity plot, consequent to which zero resistance is obtained around 75K, although the onset is above 110K. Magnetic measurements indicate the presence of almost equal fractions of two superconducting phases with transition temperatures of 110K and about 80K. The microstructure of these samples has been examined using several transmission electron microscopy techniques. The superconducting phases exhibit a polytypoid type structure with the general formula of Bi$_2$Sr$_2$Ca/sub n-1/Cu/sub n/O/sub y/, where n takes on values of 1,2,3 and in some infrequent cases 4. The c-parameter and T/sub c/ increase with n. In almost all the superconducting grains, the lower T/sub c/(n = 1 or 2) polytypoid is observed at the grain boundaries. Thus, the 110K polytypoid in each grain is not "connected" to similar regions in other grains. The lower T/sub c/ polytypoid is observed at the grain boundaries due to a reduction Ca and/or Cu. It is suggeted that the controlled addition of PbO enables the formation of a Pb-rich liquid phase which makes the composition near the grain boundaries uniform. Consequently, the step in the resistivity plot disappears. 19 refs., 6 figs.

56995 **(LBL—25844) Modulated structure of superconducting Bi$_2$CaSr$_2$Cu$_2$0 /sub 8+δ/.** Gronsky, R.; Fendorf, M.; Fortunati, K.; Hor, P.; Meng, R.L.; Chu, C.W. (Lawrence Berkeley Lab., CA (USA)). May 1988. Contract AC03-76SF00098. 3p. (CONF-880841—20). NTIS, PC A02/MF A01. Order Number DE89000556/JAW.

From MAS/EMSA microbeam analysis conference; Milwaukee, WI, USA (7 Aug 1988).

In the continuing search for new oxide superconductors, attention has recently been drawn to the Bi-Sr-Cu-O system. Independent pursuits by the groups in Japan and Houston led to their simultaneous announcements of a new material with consistently high transition temperatures in the 100K range. This new compound is believed to have nominal composition Bi$_2$CaSr$_2$Cu$_2$O/sub 8+δ/ and orthorhombic unit cell dimensions of a = 5.44{angstrom}, b = 27.2{angstrom}, and c = 30.78{angstrom}. Subsequent electron microscopy investigations of the material identified both an incommensurate structure, and a two phase mixture, related structurally to the original Bi$_2$CaSr$_2$Cu$_2$O/sub 8+δ/ phase. This investigation seeks further understanding of the microstructure of the new compound by a transmission electron microscopy study of single crystals (T/sub c/ = 85K) grown at the University of Houston. 6 refs., 4 figs.

56996 **(LBL—25968) Microstructure and magnetic properties of Ba$_2$Cu/sub 0.8/Zn/sub 1.2/Fe$_{12}$O$_{22}$.** Huynh, T. (Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC03-76SF00098. 66p. NTIS, PC A04/MF A01. Order Number DE89000551/JAW.

The Y-type hexagonal ferrite Ba$_2$Cu/sub 0.8/Zn/sub 1.2/Fe$_{12}$O$_{22}$ has been characterized by x-ray diffraction, transmission electron microscopy, analytical electron microscopy, and Lorentz microscopy. Specimens were magnetically oriented so that the c-

axes of the hexagonal grains were aligned. The structure was confirmed to have R3m symmetry. The general microstructure consisted of grains about 10μm in diameter and 2μm in thickness. Intragranular CuZn-ferrite particles were found in some of the grains. The structure of these particles was determined to be diamond cubic with a lattice parameter {approximately}8.4 {angstrom}A and the close-packed plane and the close-packed direction parallel to the close-packed plane and the close-packed direction of the matrix phase. The grains contained faults with the fault plane parallel to the basal plane of the grains. Theoretical calculation showed that domain formation in thin ferrite specimens was very energetically unfavorable. 23 refs., 29 figs., 8 tabs.

56997 **(PB—88-241880/XAB) Fibrous alumina-silica insulation board as a candidate standard reference material of thermal resistance.** Hust, J.G.; Smith, D.R. (National Bureau of Standards, Boulder, CO (USA). Chemical Engineering Science Div.). Jun 1988. 34p. (NBSIR—88/3094). NTIS, PC A03/MF A01.

Measurements of apparent thermal conductivity are reported in order to provide the basis for certifying fibrous alumina-silica insulation board as a Standard Reference Material (SRM) of thermal resistance. These data encompass ranges of temperature from 93 to 746 K, densities from 207 to 308 kg/m^3, and fill-gas pressures from roughing-pump vacuum to atmospheric pressure, in environments of both air and helium. Detailed analyses and intercomparisons of previously published data are given.

56998 **(SKB-TR—87-31) Rheological properties of a calcium smectite.** Boergesson, L.; Pusch, R. (Sveriges Geologiska AB, Lund). (Swedish Nuclear Fuel and Waste Management Co., Stockholm). Dec 1987. 127p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755272/JAW.

The rheological and mechanical properties of a Ca-smectite have been investigated by different laboratory tests. By these tests the permeability, the water uptake properties, the swelling properties, the swelling pressure, the stress-strain properties, the strength and the creep properties have been determined. The influence of density, temperature, time and stress level have been considered. Mathematical models of the measured properties and behavior of the clay have been suggested so that calculations involving mechanical and rheological scenarios can be made. The behavior of the clay have been discussed with reference to the microstructure and comparisons between the investigated Ca-smectite and a Na-smectite (Mx-80) have been made. One main conclusion is that the difference between the properties and behavior of Ca-smectite and Na-smectite is small at densities >2.0 t/m/sup 3/. At densities <2.0 t/m/sup 3/ the difference is increasing with decreasing density.

56999 **Microstructure of Pb-modified Bi-Ca-Sr-Cu-O superconductor.** Ramesh, R.; Thomas, G.; Green, S.M.; Mei, Y.; Jiang, C.; Luo, H.L. (Department of Materials Science and Mineral Engineering and National Center for Electron Microscopy, Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Applied Physics Letters;* **53**: No. 18, 1759-1761(31 Oct 1988).

The microstructure of samples with and without Pb addition has been characterized by transmission electron microscopy. An amorphous Pb-rich grain boundary phase has been found in Pb-doped samples. It is suggested that a Pb-rich liquid phase assists sintering and homogenization of the composition of the superconducting phase to attain the higher zero T/sub c/. In both samples, Ca replacement by Bi has been found. The implications of such a replacement are briefly discussed.

57000 **Cubic zirconia as a species permeable coating for zinc diffusion in gallium arsenide.** Bisberg, J.E.; Dabkowski, F.P.; Chin, A.K. (Microelectronics and Materials Center, Polaroid Corporation, Cambridge, Massachusetts 02139). *Applied Physics Letters;* **53**: No. 18, 1729-1731(31 Oct 1988).

Diffusion of zinc into GaAs through an yttria-stabilized cubic zirconia (YSZ) passivation layer has been demonstrated with an open-tube diffusion method. Pure zinc or GaAs/Zn_3As_2 sources produced high quality planar p-n junctions. The YSZ layer protects the GaAs surface from excessive loss of arsenic, yet is permeable to zinc, allowing its diffusion into the semiconductor. The YSZ films, deposited by electron beam evaporation, were typically 2000 A thick. Zinc diffusion coefficients (D/sub T/) at 650 °C in the YSZ passivated GaAs ranged from 3.6 x 10^{-10} cm^2/min for the GaAs/Zn_3As_2 source to 1.9 x 10^{-9} cm^2/min for the pure zinc source. Doping concentrations for both YSZ passivated and uncapped samples were approximately 5 x 10^{19} cm^{-3}.

57001 **Fluss et al. reply.** Fluss, M.J.; Jean, Y.C.; Turchi, P.E.A.; Wachs, A.L.; Howell, R.H. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review Letters;* **61**: No. 17, 2004-2004(24 Oct 1988).

A reply to the comment on Evidence for a common high-temperature superconducting effect in LaSrCuO and YBaCuO is presented.It is conteted that a short diffusion length for thermalized positrons enables to probe the bulk properties of polycrystaline samples of the above mensioned in which the grain sizes were measured to be 10 to the power -6 meter,and thus to compare the results with the single-crystal YBaCuO. (AIP)

57002 **Magnetic susceptibility of Pr^{4+} in $BaPrO_3$: evidence of long-range magnetic order.** Bickel, M.; Goodman, G.L.; Soderholm, L.; Kanellakopulos, B. (Argonne National Lab., IL (USA)). *Journal of Solid State Chemistry;* **76**: No. 1, 178-185(Sep 1988).

The authors have reexamined the magnetic behavior of $BaPrO_3$ in the temperature range $4.2 < T < 300$ K. An anomaly in the susceptibility at 11.6(1) K has been observed, and is attributed to the onset of long-range ordering of the Pr^{4+} f-electrons. Above the critical temperature, the paramagnetism is composed of a temperature-dependent term with an effective moment of 0.7(1) μ/sub B/ and a temperature-independent term of 6.9(2) x 10^{-4} emu/mole. Calculations based on a simple crystal field model explain the low effective moment found experimentally.

57003 **(K/TR—88/5) A manufacturing process for hexaborides of rare-earth metals.** Uchida, Kenji. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 1988. Contract AC05-84OT21400. Translation of Japanese Patent 52-78799, July 2, 1977. 10p. NTIS, PC A02/MF A01. Order Number DE89001023/JAW.

The object of the present invention is to provide a manufacturing process involving the electrolysis of dissolved salts, in which multiple crystallines of hexaborides of rare-earth metals such as lanthanum boride and those of lanthanide or actinide, which are very promising materials that have a superior degree of thermal electron radioactivity and can be used for electrodes, can easily be leached and removed.

57004 **Changes in microwave absorbtion of new high T/sub c/ superconductors with small magnetic fields.** Khachaturyan, K.; Weber, E.R.; Tejedor, P.; Stacy, A.; Portis, A. (Lawrence Berkeley Lab., Berkeley, CA (US)). pp 383-386 of High-temperature superconductors. Brodsky, M.B.; Dynes, R.C.; Kitazawa, K.; Tuller, H.L. Pittsburgh, PA; Materials Research Society (1988). (CONF-8711114—).

From Symposium on high temperature superconductors; Boston, MA, USA (30 Nov 1987).

A low field microwave absorption peak was observed with an EPR spectrometer in the new superconducting oxides. The peak disappeared above the superconducting transition temperature after exponential decrease with temperature in the transition region. The peak was sensitive to the magnetic fields the sample has been exposed before in the superconducting phase. Magnetic field dependent stochastic oscillations of the EPR baseline are ascribed to flux trapping in Josephson junctions.

57005 **Electronic structure of fluorine-substituted YBa/sub 2/Cu/sub 3/O/sub 7/ superconductor.** Ching, W.Y.; Xu, Y.; Wong, K.W. (Dept. of Physics, Univ. of Missouri-Kansas City, Kansas City, MO (US)). pp 403-406 of High-temperature superconductors. Brodsky, M.B.; Dynes, R.C.; Kitazawa, K.; Tuller, H.L. Pittsburgh, PA; Materials Research Society (1988). (CONF-8711114—).

From Symposium on high temperature superconductors; Boston, MA, USA (30 Nov 1987).

The electronic structures of fluorine-substituted YBa/sub 2/Cu/sub 3/O/sub 7/ crystals are studied by means of first-principles calculations. The most likely site of substitution is O(1) and the most unlikely site is O(4).

57006 **Synthesis study of superconducting YBa/sub 2/Cu/sub 3/O/sub 7-x/ powders from metal-alkoxides.** Wu, K.; Kramer, S.; Kordas, G. (Dept. of Materials Science and Engineering, Ceramics Div. and Materials Research Lab., Univ. of Illinois at Urbana-Champaign, 105 S. Goodwin Ave., Urbana, IL (US)). pp 395-398 of High-temperature superconductors. Brodsky, M.B.; Dynes, R.C.; Kitazawa, K.; Tuller, H.L. Pittsburgh, PA; Materials Research Society (1988). (CONF-8711114—).

From Symposium on high temperature superconductors; Boston, MA, USA (30 Nov 1987).

The authors have synthesized orthorhombic phase YBa/sub 2/Cu/sub 3/O/sub 7-x/ superconductors by using metal alkoides. Cu (II) ethoxide was first partially dissolved in toluene, followed by the addition of Bamethoxyethoxide and Y-methoxyethoxide in methoxyethanol to further enhance the solution solubility. A homogeneous gel-like paste was obtained both by adding water to the stock solution and by exposing it to the atmosphere. The gels were then vacuum dried and fired at 800 and 850°C in flowing O/sub 2/. The superconducting transition temperature was 90 + K.

57007 **Penetration depth measurements of YBa/sub 2/Cu/sub 3/O/sub 7-δ/ at 4 MHz.** Wiesmann, H.; Corderman, R.R.; Moodenbaugh, A.R.; Ruckman, M.W.; Strongin, M. (Brookhaven National Lab., Upton, NY (US)). pp 387-390 of High-temperature superconductors. Brodsky, M.B.; Dynes, R.C.; Kitazawa, K.; Tuller, H.L. Pittsburgh, PA; Materials Research Society (1988). (CONF-8711114—).

From Symposium on high temperature superconductors; Boston, MA, USA (30 Nov 1987).

Measurements were made of the penetration depth of bulk and powder samples of YBa/sub 2/Cu/sub 3/O/sub 7-δ/. The samples were placed in an inductor which was part of the resonant circuit of a 4 MHz tunnel diode oscillator. The oscillator was stable to at least 1 part in 10/sup 6/ at 77 K. Changes in the sample susceptibility were easily detected by changes in the oscillator frequency. Analysis of the smallest powders fabricated gave a value of the measured penetration depth λ/sub mea/ = 0.23 μm. The measurement methodology is quantitative and the value of λ/sub mea/ is believed to be an upper bound of the true penetration depth.

57008 **Oxygen stoichiometry and superconductivity in Ho/sub 1/Ba/sub 2/Cu/sub 3/O/sub 7-x/.** Sales, B.C.; Kim, Y.C.; Thompson, J.R.; Christen, D.K.; Boatner, L.A.; Sekula, S.T. (Oak Ridge Nat. Lab., Oak Ridge, TN (US)). pp 591-594 of High-temperature superconductors. Brodsky, M.B.; Dynes, R.C.; Kitazawa, K.; Tuller, H.L. Pittsburgh, PA; Materials Research Society (1988). (CONF-8711114—).

From Symposium on high temperature superconductors; Boston, MA, USA (30 Nov 1987).

The effects of varying oxygen content on the superconducting transition temperature T/sub c/, resistivity, and crystal structure of HoBa/sub 2/Cu/sub 3/O/sub 7-x/ ($0 < x < 1$) have been investigated. The variation of T/sub c/ with x is very similar to that previously reported by several authors for YBa/sub 2/Cu/sub 3/O/sub 7-x/. In particular a plateau in the T/sub c/ vs x curve is observed for values of x between 0.3 and 0.4 with the value of T/sub c/, (10% onset measured magnetically) remaining relatively constant at about 55 K. The width of the superconducting transition, as measured both resistively and magnetically, is substantially narrower for x = 0.35 +- 0.05 than for slightly larger or smaller values of x. Both resolution powder x-ray diffraction analysis was used to measure the lattice complaints of both the orthorhobmic and tetragonal phases as x was varied. With increasing x the temperature coefficient of the resistivity changed from positive (metallic) for $x \leqq 0.2$ to negative (semiconducting) for $x \geqq 0.3$. Since the general shape of the T/sub c/ vs x curve was unaffected by the complete substitution of magnetic Ho for Y, these results suggest an ordering of the oxygen vacancies in the a-b plane and the existence of an ordered compound with a T/sub c/ of 55 K.

57009 **Radiation damage in YBa/sub 2/Cu/sub 3/O/sub 7/ by fast neutrons.** Willis, J.O.; Cost, J.R.; Brown, R.D.; Thompson, J.D.; Peterson, D.E. (Los Alamos National Lab., Los Alamos, NM (US)). pp 391-394 of High-temperature superconductors. Brodsky, M.B.; Dynes, R.C.; Kitazawa, K.; Tuller, H.L. Pittsburgh, PA; Materials Research Society (1988). (CONF-8711114—).

From Symposium on high temperature superconductors; Boston, MA, USA (30 Nov 1987).

The superconducting transition temperature of sintered YBa/sub 2/Cu/sub 3/O/sub 7/ decreases at a rate of 2.7 K/10/sup 18/ n/cm/sup 2/ (E > 0.1 MeV) for fast neutron irradiation. The critical current density J/sub c/ increases a factor of three at zero field and more than three at nonzero fields for fluences up to 2 x 10/sup 18/ n/cm/sup 2/. At both 7 and 75 K, J/sub c/ is decreasing with fluence near 3 x 10/sup 18/ n/cm/sup 2/.

57010 **Dynamic high pressure process for fabricating superconducting and permanent magnetic materials.** Nellis, W.J.; Maple, M.B.; Geballe, T.H. US Patent Application 6-111,544. 23 Oct 1987. 45p. Contract W-7405-ENG-48. NTIS, PC A03/MF A01.

Shock wave formation of superconductive ceramic oxide electric and magnetic circuit elements with improved microstructures and mechanical properties. 10 figs.

57011 **Shock-induced synthesis of high temperature superconducting materials.** Ginley, D.S.; Graham, R.A.; Morosin, B.; Venturini, E.L. US Patent Application 6-063,555. 18 Jun 1987. 27p. Contract AC04-76DP00789. NTIS, PC A03/MF A01.

It has now been determined that the unique features of the high pressure shock method, especially the shock-induced chemical synthesis technique, are fully applicable to high temperature superconducting materials. Extraordinarily high yields are achievable in accordance with this invention, e.g., generally in the range from about 20% to about 99%, often in the range from about 50% to about 90%, lower and higher yields, of course, also being possible. The method of this invention involves the application of a controlled high pressure shock compression pulse which can be produced in any conventional manner, e.g., by detonation of a high explosive material, the impact of a high speed projectile or the effect of intense pulsed radiation sources such as lasers or electron beams. Examples and a discussion are presented.

57012 **Process for producing ceramic nitrides anc carbonitrides and their precursors.** Brown, G.M.; Maya, L. US Patent Application 6-018,390. 25 Feb 1987. 9p. Contract AC05-84OR21400. NTIS, PC A02/MF A01.

A process for preparing ceramic nitrides and carbon nitrides in the form of very pure, fine particulate powder. Appropriate precursors is prepared by reaching a transition metal alkylamide with ammonia to produce a mixture of metal amide and metal imide in the form of an easily pyrolyzable precipitate.

57013 **(Y/TR—88/2) A manufacturing process for molded ceramic articles.** Higashi, Hirofumi; Hayashi, Toshio. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). [1988]. Contract AC05-84OS21400. Translation of Japanese Patent 54-21413, February 1979. 6p. NTIS, PC A02/MF A01. Order Number DE89001026/JAW.

Kaolin is calcined at high temps., ground into ceramic granules, then mixed with an appropriate amt. of each of a thermosetting resin, an inorganic filler, a reinforcing agent, and a catalyst into a plastic mixt. and lastly subjected to heating and compression after being packed in a mould. The method is capable of manufacturing any shape and any size of ceramic mouldings to a high di-

mension accuracy as in the case of plastics moulding, and provides high grade ceramic moulding, and provides high grade ceramic mouldings for mass production. The method esp. is suitable for the manufacture of large sized ceramic prods., e.g., bath tub, etc.

3606 Other Materials

REFER ALSO TO CITATION(S) 56327, 56450, 56450, 56450, 56539, 56594, 56594, 56677, 56735, 56822, 56853, 56873, 56980, 57010, 57103, 57103, 57125, 57126, 57177, 57199, 57248, 57344, 57441, 57572, 57616, 57766, 57766, 58275

57014 **(AD-A—194781/1/XAB) Reactions of XeF_2 with thermally grown SiO_2.** Joyce, S.; Langan, J.G.; Steinfeld, J.I. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Chemistry). 1988. 14p. NTIS, PC A03/MF A01.

Pub. in Surface Science, Vol. 195, 270-282(1988).

The reactions of XeF_2 on thermally grown SiO_2 were studied. XeF_2 does not readily undergo a dissociative chemisorption on these surfaces. Damaging the oxide with 500-eV argon ions enhances this process significantly through the creation of active sites. XPS analysis of the resulting adlayer, together with molecular-orbital model calculations, reveal the presence of fluorine bound to both silicon and oxygen. The oxyfluoride species can be removed from the surface by annealing the crystal to 200 C.

57015 **(AD-A—195172/2/XAB) MBE growth, characterization, and electronic-device processing of HgCdTe, HgZnTe, related heterojunctions, and HgCdTe-CdTe superlattices. Quarterly report.** Faurie, J.P. (Illinois Univ., Chicago (USA). Dept. of Physics). 15 Sep 1987. 21p. NTIS, PC A03/MF A01.

A strong emphasis has been laid recently on the characterization of HgCdTe epilayers by a double x-ray rocking curve. A careful examination of what has been up to now reported is far from being conclusive. In fact, what is claimed as world record is only one particular point on a crystal. Above all, nobody has presently established a clear relationship between the FWHM of X-ray Rocking-Curve peak and the electrical characteristics of this HgCdTe layer. The author received his x-ray equipment during the Summer 87 and have started our own investigations. What we have in mind is (1) to understand the relationship between FWHM of the substrate - FWHM of the epilayer, (2) to establish a relationship between FWHM mobility and carrier lifetime for a given HgCdTe MBE layer grown under very well established growth conditions. We have already characterized numerous substrates and HgCdTe epilayers grown in the (111) orientation on CdTe and CdZnTe substrates.

57016 **(AD-A—195224/1/XAB) Creep of carbon-yarn and carbon-carbon composites at high temperatures and high stresses. Technical report.** Sines, G.; Yang, Z.; Vickers, B.D. (California Univ., Los Angeles (USA). Dept. of Materials Science and Engineering). May 1988. 60p. (UCLA-ENG—88-8). NTIS, PC A04/MF A01.

To better understand the creep-behavior of carbon yarn and carbon-carbon composites, creep experiments were developed that permitted testing at high temperatures (up to 2500 C) and at high stresses (up to 850 MPa) on specially prepared, uniaxial specimens that had a known gage length. Using a Dorn-type power-law relation to model steady-state creep, the apparent activation energy for the carbon-yarn and carbon-composite specimens was determined to be 1082 kj/mol. This value represents a single thermally activated process, vacancy diffusion, that compares favorably with the various types of graphitizable carbon. The value determined for the stress exponent was 7.5. It too was found to be independent of the carbon-matrix's presence and independent of the specimens' loading history. Values of the pre-exponential constant for the carbon yarn and carbon composites were also calculated. The carbon matrix greatly improves the creep resistance of the carbon composite. This improvement was attributed to the matrix's microstructure. It distributes applied loads more evenly and it may also impose a triaxial stress state in the yarns's filaments. It is proposed that such a stress state may inhibit the flux of vacancies, thus accounting in part for this increase in creep resistance.

57017 **(AD-A—195498/1/XAB) Physics and technology for the in-situ investigation of properties of materials. Annual report, 15 January 1987-14 January 1988.** Parpia, J.M.; Richardson, R.C. (Cornell Univ., Ithaca, NY (USA). Lab. of Atomic and Solid State Physics). 12 May 1988. 9p. NTIS, PC A02/MF A01.

The progress report is broken up into four sections, the first detailing the apparatus constructed, the second, results on $CoSi_2$, and third, very recent results on free-standing aluminium films and wires. In addition, results on arsenic-doped silicon are proceeding and are described briefly. Samples can be inserted into an Oxford 200 top-loading dilution-refrigerator cryostat modified to include a 7T magnet mounted on the mixing chamber. The authors also have a small independently operated solenoid used to ramp the magnetic field slowly, and to provide a zero-field environment, by nulling out trapped fields in the main solenoid. This apparatus permits transport measurements below 20 mK (5 mK in zero field), provided the sample holders are properly heat sunk. Measurements on several samples of $CoSi_2$ are reported; the first was on a 170-A layer showed that the material had a resistance ratio of approximately 5.5, with a superconducting transition at approximately 1K (mid point 0.75K), and a critical field of approximately 100 G. In this sample, a shallow minimum in resistance at 4.5 K (figure 1b) was observed, with a log T low-temperature resistance in the normal state.

57018 **(AD-B—096070/8/XAB) Static and fatigue behavior of pin-loaded metal matrix joints. Final report, May-November 1983.** Grimsley, F.M. (Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH (USA)). Jun 1984. 45p. (AFWAL-TR—84-3063). NTIS, PC A03/MF A01.

Distribution limitation now removed.

Continuously reinforced metal-matrix composites (MMC) have been projected to have the potential to save weight in aerospace structures due to their high strength and stiffness. These structures must somehow be joined together to form larger structures. Historically, the most common and most accepted method of joining structures together is through the use of fasteners with varying amounts of load transfer between them. These types of loadings are very complex and are not well understood even in conventional metals. Some work has been done for the graphite/epoxy composites but very little has been done on continuously reinforced MMC. The objective of this study was to assess the ability of current composite analysis procedures to predict the static behavior of joints made from various unidirectional MMC and to investigate the fatigue behavior of these joints when subjected to constant-amplitude loading. Specific objectives were to determine experimentally the static behavior of double-lapped shear-joint specimens made from three different MMC composites; to analytically predict the static strength of these joints and to experimentally determine whether joints under fatigue loading fail in the same manner as the statistically loaded joints. Three composite materials were chosen for testing: unidirectional B/Al, and SiC/Al and Ti clad unidirectional B4C/Al hybrid. Detailed studies of the materials' behavior were made for both the static and fatigue tests using both destructive and nondestructive evaluation methods.

57019 **(BDX—613-3926) Characterization of non-MDA-containing bismaleimide resins.** Spieker, D.A.; Larsen, F.N. (Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div.). Aug 1988. Contract AC04-76DP00613. 13p. (CONF-8810123—2). NTIS, PC A08/MF A01. Order Number DE88016676/JAW.

From 17. North American Thermal Analysis Society (NATAS) conference; Orlando, FL, USA (9 Oct 1988).

Recent regulatory action by OSHA for the workplace exposure to 4,4'-methylenedianiline (MDA) is generating considerable interest in developing non-MDA-containing thermoset resins. One such material is a new bismaleimide, 2,2'-bismaleimido(1,2 phenylthioethane), designated APO-BMI. This material has been evaluated and pilot production quantities produced for replacement of a commercially available MDA-containing bismaleimide for syntactic foam applications. A diol extended version of the APO-BMI has also been characterized. Thermal analysis has been used extensively to characterize these three materials. Comparative data for these three resins will be presented and will include cure cycle optimiza-

tion, glass transition and resin reactivity measurements by DSC, thermal and oxidative stability by TGA and coefficient of linear thermal expansion and Tg by TMA. 2 refs., 7 figs.

57020 **(BNL—41735) Orientational behavior of thin films of poly(3-methylthiophene) on platinium: A FTIR and near edge x-ray absorption fine structure (NEXAFS) study.** Yang, X.Q.; Chen, J.; Hale, P.D.; Inagaki, T.; Skotheim, T.A.; denBoer, M.L. (Brookhaven National Lab., Upton, NY (USA); Hunter Coll., New York (USA). Dept. of Physics). 1988. Contract AC02-76CH00016. 6p. (CONF-880669—22). NTIS, PC A02/MF A01. Order Number DE89001089/JAW.

From International conference on science and technology of synthetic metals; Santa Fe, NM, USA (26 Jun 1988).

Near edge x-ray absorption fine structure (NEXAFS) and infrared reflection-absorption spectroscopy (IRRAS) have been used to study the orientational behavior of thin films of poly(3-methylthiophene) electrochemically polymerized on a platinum surface. Clear orientational effects, with the thiophene rings predominantly oriented parallel to the platinum surface, were observed when the thickness of the polymer films were within a few hundred {angstrom}A. It was found that more highly ordered films were produced at lower polymerization potential (1.4V vs SCE) than at higher potential (1.8V vs SCE). 5 refs., 4 figs., 2 tabs.

57021 **(BNL—41779) Electron transport in non-polar liquids as revealed by high pressure studies and Hall mobility measurements.** Holroyd, R. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 4p. (CONF-881185—1). NTIS, PC A02/MF A01. Order Number DE88017337/JAW.

From International workshop on liquid state electronics; Berlin, F.R. Germany (7 Nov 1988).

Several significant advances have been made recently in our studies of excess electrons in non-polar liquids. These studies provide insight into the transport and chemical reactions of electrons. From high pressure studies, up to 3000 atmospheres, information about volume changes for electron transition is obtained. Hall mobility measurements, which are electron drift studies done in crossed magnetic and electric fields, reveal the transport properties of electrons in the conduction band. 8 refs., 1 tab.

57022 **(CONF-880715—10) Intermediate-range order in binary and ternary glasses.** Price, D.L.; Susman, S.; Volin, K.J.; Dejus, R.J. (Argonne National Lab., IL (USA); Uppsala Univ., Nykoeping (Sweden). Studsvik Neutron Research Lab.). Jul 1988. Contract W-31109-ENG-38. 14p. NTIS, PC A03/MF A01. Order Number DE89000612/JAW.

From 4. international conference on neutron scattering (ICNS '88); Grenoble, France (12 Jul 1988).

Intermediate-range order in binary and ternary chalcogenide glasses is discussed, with special reference to $GeSe_2$ and $Ag_4Ge_3Se_9$. A signature of this order is provided by the first sharp diffraction peak, which occurs in these glasses at Q {approximately} 1 /sup {angstrom}A//sup {minus}1/ and shows anomalous behavior in several ways. It is strongly depressed by the addition of Ag to the $GeSe_2$ glass. The addition of Ag also leads to a softening of the vibrational spectrum. 11 refs., 4 figs.

57023 **(CONF-880726—3) Characterization of network vibrational modes by means of dynamic structure factors from neutron scattering.** Price, D.L.; Susman, S.; Volin, K.J.; Dejus, R.J. (Argonne National Lab., IL (USA)). Jul 1988. Contract W-31109-ENG-38. 5p. NTIS, PC A02/MF A01. Order Number DE89000583/JAW.

From 4. international conference on structure of non-crystalline materials; Oxnard, CA, USA (18 Jul 1988).

Vibrational modes observed in the density of states of glasses may be characterized by consideration of the dynamic structure factor S(Q,E). The Q dependence of this function depends on the character of the modes with energy E through the phase factor and through correlations in the displacement vectors projected along Q of neighboring atoms. This fact is illustrated by recent results on chalcogenide glasses. 9 refs., 5 figs.

57024 **(DOE/ET/13763—1) Effects of dispersion and support on adsorption, catalytic and electronic properties of cobalt/alumina CO hydrogenation catalysts: Annual progress report, August 1, 1987-July 31, 1988.** Bartholomew, C.H. (Brigham Young Univ., Provo, UT (USA). Catalysis Lab.). 22 Aug 1988. Contract FG02-87ER13763. 5p. NTIS, PC A02/MF A01. Order Number DE89000033/JAW.

An investigation of the effects of surface structure, dispersion, and support on the adsorption, catalytic, and electronic properties of cobalt/alumina is described, the objectives of which are to determine (1) the effects of surface structure and metal dispersion on the adsorption and catalytic properties of cobalt and (2) the effects of decorating support species on metal crystallites and of direct electronic interactions between metal clusters and support, on the adsorption, catalytic and electronic properties of cobalt supported on alumina. During the first year effects of surface structure and dispersion on the adsorption, activity/selectivity, and electronic properties of Co/W single crystal surfaces and alumina-supported cobalt were investigated in a surface science investigation, lab reactor studies, TPD/TPSR studies, and a Moessbauer spectroscopy study. The structure, stability, surface electronic properties, and chemisorptive properties of vapor-deposited cobalt overlayers (0-4 ML) on W(110) and W(100) were studied by Auger electron spectroscopy, low energy electron diffraction, work function changes, and temperature programmed desorption (TPD) of cobalt, hydrogen, and carbon monoxide. The CO chemisorptive properties of the two cobalt overlayers are quite different, CO adsorption being dissociative on the W(100) surface and nondissociative on the W(110) surface; comparison of the results with those for Ni/W(100) indicate that Co/W(100) as a result of electronic interaction with the tungsten substrate. Activities and selectivities of cobalt/alumina catalysts for CO hydrogenation prepared by decomposition of $Co_4(CO)_{12}$ were determined as functions of metal loading, dispersion, and extent of reduction. Steady-state activity and product molecular weight were found to increase with increasing metal loading (decreasing dispersion and increasing extent of reduction). 10 refs.

57025 **(DP-MS—88-181) Kinetic and thermodynamic implications of some commonly used rate laws for glass dissolution.** Grant, M.W.; Plodinec, M.J. (Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 4p. (CONF-880903—35). NTIS, PC A02/MF A01. Order Number TI89001236/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, USA (11 Sep 1988).

In this paper several rate laws are examined. The concern is not with details of the dissolution of the complex waste glasses, but with the broader issues of system dynamics. Two of the rate laws, the simple linear driving force (SLDF) and linear driving force/linear driving force (LDF/LDF) models, have been successfully used to interpret the results of static glass leaching experiments. The third model, zero order/linear driving force (ZO/LDF), has been used to describe the dissolution of minerals. The SLDF and LDF/LDF models are conceptually less satisfactory because they utilize an ill-defined equilibrium state. The ZO/LDF model does not have this problem. With these rate laws we have examined several issues including (1) the interpretation of leach tests, (2) open systems, and (3) the existence of thermodynamic-kinetic relationships.

57026 **(EMR/MS—SL87-40) The effect of composition on the properties of hydronium zirpsios.** Kuriakose, A.K.; Ahmed, A.; Canaday, J.D.; Wheat, T.A. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Mineral Sciences Lab.). Mar 1987. 15p. (MICROLOG—88-00756). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The preparation and characterization of hydronium zirpsios (hydrogen-ion conducting Nasicons with the general formula: Na(H/sub 3/O)/sub x/Zr/sub 2/Si/sub x/P/sub 3-x/O)/sub 12/) as a function of their x values (between x=0.5 and x=2.0) are reported. Thermogravimetric analysis of these materials show that their thermal stability increases with a decrease in the x value. Although thermal stability is highly desirable for these products, the fabrication of membranes has been successful only using compositions

with x ≧ 1.5. Currently, the composition with x=1.5 appears to be the most promising, based on physiocochemical properties and hydrogen-ion conductivity. 3 refs., 5 figs., 1 tab.

57027 (INIS-BR—1229, pp 7) **Magnetism and crystal field properties of the RE/sub 2/Fe/sub 14/BH/sub x/ alloys (RE = Y, Ce, Dy, Er) from Moessbauer spectroscopy.** Friedt, J.M.; Sanchez, J.P; L'Heritier, P.; Fruchart, R. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57028 (INIS-BR—1229, pp 9) **TDPAC and Moessbauer measurements of hyperfine fields in chromium-based chalcogenide spinels.** Jha, S.; Elfazani, M.; Yehia, S.; Mitros, C.; Kumar, S.; Julian, G.M.; Dunlap, R.A.; Vasquez, A.; Cunha, J.B.M. da; Ramos, S.M.M. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57029 (INIS-SU—36, pp 65-71) **Synthesis of inorganic materials in plasma and under accelerated electron beam.** Livshits, E.V.; Shevyakova, Eh.P.; Polyashenko, R.F.; Kantsedal, V.P. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88780176/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(39).

In Radiation damage physics and radiation material technology. Scientific-technical collection.

Methods of crystal opics and infrared spectroscopy were used to study peculiarities of synthesis under irradiation and in plasma of the following inorganic compounds: complex oxides (NiCr/sub 2/O/sub 4/, NiAl/sub 2/O/sub 4/ spinels, NiFe/sub 2/O/sub 4/ ferrite, (Fe, Cr)/sub 2/O/sub 3/ solid solution) and model compound of Na/sub 2/MgSiO/sub 4/ orthosicate. Synthesis was conducted by three methods: solid-phase sintering in the air at 600...1500 deg C, in plasma of electric arc plasmotron and under accelerated electron beam. Conducted investigations showed that synthesis of complex oxides under electron irradiation achieved the maximum at the temperature by 200...300 deg C lower as compared to the temperature of synthesis in the furnace. Oxide interaction in plasma during short period of time also results in preparation of complex compounds. Correlation of synthesis conditions in plasma and under electron beam irradiation enables to consider that reactions of spinel and ferrite formation in binary oxide systems NiO-Cr/sub 2/O/sub 3/, NiO-Al/sub 2/O/sub 3/, NiO-Fe/sub 2/O/sub 3/, Fe/sub 2/O/sub 3/-Cr/sub 2/O/sub 3/ under acelerated electron beam proceed at lower temperatures. This testifies to the fact that processes of radiation induced diffusion affect sufficiently synthesis procedure, besides thermal effect. 7 refs.; 4 figs.

57030 (INIS-SU—41, pp 35-37) **Influence of thermal cycling on radiative resistance of the Pb/sub 1-x/Sn/sub x/Te epitaxial layers to X radiation.** Pashkovskij, M.V.; Filimonenko, E.P.; Matveenko, A.V.; Kramchenko, O.A. (L'vovskij Gosudarstvennyj Univ. (Ukrainian SSR)). 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780008/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 2(40).

In Radiation-induced damage physics and material technology. Scientific-technical collection.

Thermal cycling effect within 77-300 K region on x-radiation resistance for Pb/sub 1-x/Sn/sub x/Te epitaxial layers with In addition is investigated. It is ascertained that residual conductivity amplitude under x-ray irradiation depends non-linearly on the thermal cycle quantity and appears to be a curve with extremum, the position of which depends on the current value through samples. Results are interpreted within the framework of representations concerning pre-threshold defect formation under x-ray quantum effect. 9 refs.; 2 tabs.

57031 (KFKI—1987-54/E) **Recent progress in the application of soft magnetic amorphous materials: Alloys, preparation, devices.** Konczos, G.; Kisdi-Koszo, E.; Lovas, A. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). 1987. 27p. (CONF-8709353—1). NTIS (US Sales Only), PC A03. Order Number DE88016022/JAW.

From 8. international conference on soft magnetic materials; Badgastein, Austria (1 Sep 1987).

Since the discovery of ferromagnetism in amorphous alloys ongoing interest has been shown in magnetic properties of a number of glassy metals and in their practical applications. From time to time, progress in this area has been reviewed in invited lectures at conferences. Since the early eighties similar interest is observable in Eastern Europe, as well as in China and India. Ever since the Bratislava Conference in 1977, separate sections have been devoted to soft magnetic amorphous alloys and to the applications of metallic glasses. The present lecture sets out to summarize progress since the Blackpool Conference, and is based on conference proceedings, contributed papers and our own results. The word "applications" is considered in a complex manner, viz., not only do we discuss devices but we also deal with a number of factors that have an indirect influence on the practical use (type of materials, methods of rapid solidification, annealings, etc.). 111 refs., 1 tab.

57032 (LA-UR—88-2650) **Comparison of surface modification of poly(ether urethanes) on physical properties and blood compatibility.** Wrobleski, D.A.; Cash, D.L.; Hermes, R.E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 6p. (CONF-8810161—1). NTIS, PC A02/MF A01. Order Number DE88016333/JAW.

From Society of Plastic Engineers meeting; Boston, MA, USA (4 Oct 1988).

Because of their good elastomeric properties including the ability to undergo repeated flexing without failure, polyurethanes are used in a number of biomedical applications including flexing diaphragms or coatings on surfaces in artificial hearts and heart assist devices. In particular, the poly(ether urethanes), are preferred for use in biomedical applications because of their greater hydrolytic stability as compared to poly(ester urethanes). However, poly(ether urethanes), as other polymeric materials in contact with blood, cause formation of thrombus and bacterial infections. These problems might be overcome by incorporation of antithrombogenic substances and/or antibacterial agents in the surface of the polymer. We have explored both of these methods by examining the infusion of polyvinylpyrrolidone (PVP) and poly(ethylene glycol) (PEG) into commercially available poly(ether urethanes) and the graft polymerization of N-vinyl pyrrolidone onto poly(ether urethanes). Preliminary results are presented here. 7 refs., 1 fig.

57033 (LA-UR—88-2688) **Experiments with three identical ultraprecision machine tools.** Evans, C.; Hannah, P.; Rhorer, R. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 24p. (CONF-8808120—1). NTIS, PC A03/MF A01. Order Number DE88016324/JAW.

From Conference on advances in optical fabrication and metrology; San Diego, CA, USA (14 Aug 1988).

This paper outlines the underlying philosophy of, and reports preliminary results from experiments with three nominally identical diamond turning machines. Identical tools, specially fabricated from the same diamond, were used to machine mirrors from blanks cut from the same base material using previously specified process parameters; parts produced are compared. 8 refs., 14 figs.

57034 (LA-UR—88-2782) **Radiation-induced transient absorption in single mode optical fibers.** Looney, L.D.; Lyons, P.B. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 9p. (CONF-8809105—3). NTIS, PC A02/MF A01. Order Number DE89000392/JAW.

From SPIE O-E Lase: international symposium and exhibition on fiber optics, optoelectronics and laser applications; Boston, MA, USA (6 Sep 1988).

This paper reviews the measurements conducted by the Los Alamos National Laboratory in support of these NATO efforts

wherein radiation-induced transient absorption was measured over time ranges from a few ns to several μs for two single mode fibers. Experimental conditions were varied to provide data for future development of standarized test conditions for single mode fibers. 8 refs., 11 figs.

57035 **(LA-UR—88-3019) Composite foams.** Nyitray, A.M.; Williams, J.M. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 14p. (CONF-880789—2). NTIS, PC A03/MF A01. Order Number DE89000368/JAW.

From Advanced materials workshop; Livermore, CA, USA (26 Jul 1988).

Composite foams have been prepared which incorporate the best attributes of two materials. Polystyrene emulsion foams have the advantages that they can be prepared easily over a wide range of densities (.015 g/cc to 0.20 g/cc) and are easy to handle and machine; however, the small cell sizes needed for good wicking of the DT liquid fuel are difficult to achieve. On the other hand, Si aerogel and resole foams have the desired small cell size (<0.1 μm), but the materials are mechanically weak making them difficult to handle and machine. Using a backfilling process, we have been able to make binary composite foams in which the cells of the polystyrene emulsion foam have been filled with aerogel or resole foam. These materials have the small cell sizes needed for good wicking of the liquid DT fuel and are rugged and easy to machine. 3 refs., 8 figs.

57036 **(LBL—25147) Morphological evolution of pore channels in alumina.** Roedel, J.; Glaeser, A.M. (Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC03-76SF00098. 23p. (CONF-8805164—2). NTIS, PC A03/MF A01. Order Number DE89000559/JAW.

From Symposium on the sintering of advanced ceramics; Cincinnati, OH, USA (1 May 1988).

The morphological evolution of pore channels in sapphire bicrystals during annealing at 1800{degree}C has been studied. The effects of boundary crystallography as well as channel orientation within the boundary plane have been examined by using bicrystals with channels etched into either the (0001) or the (1120) planes, and oriented parallel to the [1100] and [1120] directions for the (0001) plane and parallel to the [1100] and [0001] directions in the (1120) plane. The critical aspect ratio for breakup into multiple pores, the kinetics of breakup, and the apparent surface diffusivity are affected by changes in channel crystallography. These behavioral differences are attributed to surface energy anisotropy effects. 23 refs., 7 figs.

57037 **(LBL—25779) Inversion boundaries in GaAs grown on Si.** Liliental-Weber, Z.; O'Keefe, M.A.; Washburn, J. (Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC03-76SF00098. 20p. (CONF-880841—21). NTIS, PC A03/MF A01. Order Number DE89000568/JAW.

From MAS/EMSA microbeam analysis conference; Milwaukee, WI, USA (7 Aug 1988).

Inversion boundaries in GaAs grown on Si were investigated by high-resolution transmission electron microscopy. These boundaries were found to microscopically follow {110} planes, even when they appeared macroscopically along other planes, such as {111}. High resolution micrographs from edge-on {110} inversion boundaries were taken in [110] and [100] projection. In certain areas, shifts of the images of {111} and {200} planes across the boundaries were observed. Image simulations confirmed that the visibility of these shifts can only be observed for specific imaging conditions and within a limited range of sample thickness. 22 refs., 7 figs.

57038 **(LBL—25889) The production and characterization of mid-gap states in trans-polyacetylene.** Hoener, C.F. (Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC03-76SF00098. 142p. NTIS, PC A07/MF A01. Order Number DE89000273/JAW.

Photoinduced ir absorptions with much longer lifetimes and lower excitation energies than previously reported were observed after the photolysis of polyacetylene with $\upsilon > 5000\ cm^{-1}$. These absorptions are similar to those previously reported to have millisecond lifetimes, and are attributed to charged bond-alternation defects. The persistent photoinduced absorptions could be depleted by photoexcitation of a transition with an absorption maximum near $4000\ cm^{-1}$. Unpaired spins were observed to develop and be depleted at the same photolysis frequencies as the ir activity. These spins may be due to the charged defects. This would mean that the defects are charged polarons. The temperature required to dope polyacetylene chemically was measured for various dopants. This was taken to be a measure of the activation energy for the doping reaction. The activation energies were found to be much lower than predicted by stepwise reaction mechanisms. Photolysis with above-band-gap light did not alter the temperature required for reaction. The chemical stabilization of photoinduced defects does not occur at a perceptible rate at lower temperatures than the chemical doping reaction. 35 refs., 26 figs., 14 tabs.

57039 **(NAGRA-NTB—12) Anhydrite as host rock for the final disposal of radioactive wastes in Switzerland.** Gassmann, J.; Gysel, M.; Schneider, J.F. (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Jan 1979. 121p. (In German). Nagra, CH-5401 Baden, Switzerland.

The report contains a description and judgement of the petrographical properties of the anhydrite as a possible host rock for the final disposal of radioactive wastes in Switzerland. Described are the mechanical properties of the anhydrite, changes during temperature increases, thermal conductivity, swelling behaviour, solubility, water impermeability, irradiation and corrosion behaviour. 6 figs., 29 tabs.

57040 **(NAGRA-NTB—82-05) Manufacture and homogeneity of highly dense bentonite samples.** Bucher, F.; Jeger, P.; Kahr, G.; Lehner, J. (Eidgenoessische Technische Hochschule, Zurich (Switzerland)). (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Dec 1982. 23p. (In German). Nagra, CH-5401 Baden, Switzerland.

A project study on behalf of Nagra for high radioactive waste disposal in deep geological formations as well as literature studies have shown that bentonite could be a suitable filling and sealing material. The Institute for Foundation and Soil Mechanics of the Swiss Institute of Technology is under contract by Nagra to investigate different bentonites. The investigations concentrate on the Na-bentonite MX-80 from Wyoming, which is foreseen by the Swedes, and on the geographically more favorable Ca-bentonite Montigel from Bavaria. Montigel powder and granulate, which show certain manufacturing advantages, were investigated. Numerous experiments, mostly for manufacturing of sample bodies for swelling experiments, were performed and evaluated with the aim to clarify the condensation properties of bentonites in a highly dense field. Especially the relationship between water content, pressure and attained dry density for the three bentonites: MX-80 (granulate), Montigel (powder) and Montigel K (granulate) were investigated. It was shown that the delivery water contents of the three bentonites favorably lie within the 8-10 % necessary to prepare high density samples with dry densities of about 2.0 Mg/m/sup 3/. The comparison of the three bentonites shows that both bentonites in granular form allow lower pressures at condensation than the bentonite in powder form. Based on x-ray and pressure porosimetry investigations the high density bentonites are largely homogeneous sample bodies considering their density and pore radius distribution. 15 figs., 2 tabs.

57041 **(NAGRA-NTB—82-06) Heat conductivity of bentonite MX80 and Montigel using the hot wire method.** Kahr, G.; Mueller-von Moos, M. (Eidgenoessische Technische Hochschule, Zurich (Switzerland)). (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Dec 1982. 22p. (In German). Nagra, CH-5401 Baden, Switzerland.

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57042 **(NUREG/CR—5182) The Seismic Category I Structures Program: Results for FY 1986.** Bennett, J.G.; Dove, R.C.; Dunwoody, W.E.; Farrar, C.R.; Goldman, P. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Los Alamos National Lab., NM (USA)). Sep 1988. Contract W-7405-ENG-36. 61p. (LA—11377-MS). NTIS, PC A04/MF A01 - GPO. Order Number TI89000469/JAW.

The accomplishments of the Seismic Category I Structures Program for FY 1986 are reported. The background leading to the FY 1986 Program Plan is summarized and the design of a new geometric configuration of a reinforced concrete shear wall test structure is described. The report discusses static and seismic testing of two of these structures, a 1/4-scale, 1-in.-thick shear wall model of microconcrete and a 4-in.-thick shear wall prototype. Results and conclusions regarding degrading stiffness characteristics, natural frequencies, and scalability of microconcrete with actual concrete are compared with past fiscal year results. Possible base rotation effects for the large structure are examined analytically. Finally, tentative conclusions are stated regarding the degrading stiffness and scaling of these structures and recommendations are made about future seismic testing of large structures. 11 refs., 28 figs., 9 tabs.

57043 **(PB—88-232491/XAB) Effect of different natural-flake graphite additions on the high-temperature properties of a dolomite-carbon refractory. Report of Investigations/1987.** Bennett, J.P. (Bureau of Mines, Tuscaloosa, AL (USA)). 1987. 19p. (BM-RI—9111). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600080.

The Bureau of Mines investigated the role of imported natural-flake graphite in dolomite-carbon refractories used in steelmaking processes. Fundamental engineering data were obtained to enable the evaluation of substitute materials. Changes in oxidation resistance (2,000 F), hot strength (2,750 F), and deformation under load (2,750 F) caused by 10-wt-pct additions of five different kinds of natural-flake graphite and increasing quantities (0 to 30 pct) of a 90-pct-carbon natural-flake graphite were studied. Results indicated that carbon purity of 10-wt-pct-graphite additions did not influence hot-strength deformation under load. Additions of a boron-treated graphite caused significantly higher strength and lower deformation under load at high temperatures, while an addition of ball clay significantly reduced strength and increased deformation.

57044 **(PB—88-867767/XAB) Coating optical fibers. January 1976-August 1988 (Citations from the US Patent data base). Report for January 1976-August 1988.** (National Technical Information Service, Springfield, VA (USA)). Aug 1988. 54p. NTIS PC N01/MF N01.

This bibliography contains citations of selected patents concerning methods, materials, and equipment for coating optical fibers. Selected patents include coating compositions, plastic and silicone coating materials, ultraviolet-curable coatings, hermetic coatings, methods for splicing coated optical fibers, coated fibers for optical transmission, fiber-reinforced coatings, and metal coatings. Specific properties of optical-fiber coatings including heat resistance, environmental corrosion protection, shrinkage and degradation prevention, and reduction of microbending losses, are presented. (Contains 94 citations fully indexed and including a title list.)

57045 **(PNL-SA—16145) Characterizing waste glass durability: A highly-constrained 11-component mixture case study.** Piepel, G.F.; Mellinger, G.B.; Reimus, M.A.H. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1988. Contract AC06-76RL01830. 28p. (CONF-880872—5). NTIS, PC A03/MF A01. Order Number DE88015929/JAW.

From Joint statistical meetings; New Orleans, LA, USA (22 Aug 1988).

Mixture experiments involving a large number of components and both single- and multiple-component constraints have received little exposure in the literature. This paper presents a case study involving such a mixture experiment. The case study deals with characterizing the chemical durability (resistance to leaching) of an 11-component reference waste glass. Because the composition of the glass will vary around the reference composition during production, the problem actually involves characterizing chemical durability over a region of glasses. This involves several steps: defining the compositional region, selecting a test matrix of compositions via computer-aided experimental design techniques, leach testing, empirical modeling of the leach test results, investigating glass component effects, and using statistical confidence statements to describe chemical durability over the compositional region. 10 refs., 1 fig., 6 tabs.

57046 **(SAND—88-0989C) Long-lived resonance states in Si-doped AlGaAs.** Hjalmarson, H.P.; Drummond, T.J. (Sandia National Labs., Albuquerque, NM (USA)). 15 Aug 1988. Contract AC04-76DP00789. 5p. (CONF-8808106—4). NTIS, PC A02/MF A01. Order Number DE89000305/JAW.

From 15. international conference on defects in semiconductors; Budapest, Hungary (22 Aug 1988).

Resonance states of impurities are shown to be long-lived if their coupling to the lattice is sufficiently large. The recombination of these states with band states is thermally activated which leads to extremely long lifetimes at low temperatures. Such states can explain recent experiments suggesting long-lived resonance states associated with persistent photoconductivity and "DX-centers" in Si-doped Al/sub 1-x/Ga/sub x/As for $x < 0.2$. 23 refs., 2 figs.

57047 **(SAND—88-1391) A study of the thermal stability of (In,Ga)As strained quantum well structures as a function of overlayer thickness.** Zipperian, T.E.; Jones, E.D.; Dodson, B.W.; Klem, J.F.; Plut, T.A. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 12p. (CONF-8809152—2). NTIS, PC A03/MF A01. Order Number DE88017351/JAW.

From International symposium on gallium-arsenide and related compounds; Atlanta, GA, USA (11 Sep 1988).

To investigate the effects of finite overlayer thickness on the thermal stability of strained quantum wells (SQW's), doped and undoped structures with 14 nm In/sub 0.15/Ga/sub 0.85/As SQW's, capped by 500, 50, and 20 nm of GaAs, respectively, were prepared. Photoluminescence was performed on the samples before and after a 3 s, 800{degree}C, SiO_2-capped, rapid thermal anneal and showed that samples with the thickest overlayer were thermally stable, but structures with the 20 nm cap were significantly altered. These data show that the stability of (In,Ga) As SQW's can be a strong function of overlayer thickness, and that an understanding of these effects is essential if high-temperature thermal processing is necessary for device manufacture. 16 refs., 4 figs.

57048 **(SAND—88-2361C) Processing and control of pyrolytically derived carbon films.** Renschler, C.L.; Salgado, L.V. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 3p. (CONF-8810151—1). NTIS, PC A02/MF A01. Order Number DE88015689/JAW.

From JOWOG-28 meeting; Albuquerque, NM, USA (1 Oct 1988).

We previously reported the formation of thin (200–50,000 {angstrom}) carbon films by the pyrolytic decomposition of spin-cast or solvent cast films of poly(acrylonitrile) (PAN). In this report, we describe studies which have been undertaken to gain a greater degree of control over the final properties and morphology of these films. We also describe a few of the potential applications for these films now being investigated. 4 refs., 3 figs.

57049 **(SAND—88-2376C) Low-density microcellular carbonized polyacrylonitrile (PAN) foams.** Sylwester, A.P. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 5p. (CONF-8810151—3). NTIS, PC A02/MF A01. Order Number DE88016526/JAW.

From JOWOG-28 meeting; Albuquerque, NM, USA (1 Oct 1988).

Carbon foams are of interest for numerous applications including: porous electrodes, filters, high temperature insulation, catalyst supports, and as structural materials for the fabrication of inertial confinement fusion targets. Carbon foams have improved thermal and chemical stability when compared to polymer foams and provide improved dimensional stability. We have reported a new process for preparing carbon foams which involves the preparation of low-density PAN foams which can be carbonized. The unique properties of these materials and several developing applications for carbonized PAN foams are described. 3 refs., 6 figs., 2 tabs.

57050 **(SAND—88-2579C) Interlocked fabric and laminated fabric Kevlar 49/epoxy composites.** Guess, T.R.; Reedy, E.D. Jr. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 5p. (CONF-8810151—4). NTIS, PC A02/MF A01. Order Number DE89000459/JAW.

From JOWOG-28 meeting; Albuquerque, NM, USA (1 Oct 1988).

The mechanical behavior of a novel interlocked fabric reinforced Kevlar 49/epoxy composite has been measured and compared to those of a laminated Kevlar 49 fabric composite (which served as a reference material). Both composites were 5.0 mm thick, contained the same 50% in-plane fiber volume fraction and were fabricated in a similar manner using the same Dow DER 332 epoxy, Jeffamine T403-hardened resin system. The reference material (Material 1) was reinforced with seven plies of Dupont style 1033 Kevlar 49 fabric. A photomicrograph of a section polished parallel to one of the fiber directions is shown. The interlocked fabric was designed and woven for Sandia National Laboratories by Albany International Research Co., Dedham, MA. The main design criterion was to duplicate a sewn through-the-thickness fabric used in preliminary studies. The interlocked fabric composite (Material 2) contains roughly 4% by volume of through-the-thickness fiber reinforcement for the purpose of improving interlaminar strength. A photomicrograph of a section showing the warp-aligned binder yarns interlocking the six fabric plies together is shown. 2 refs., 8 figs.

57051 **(SAND—88-2670C) Bending response of Kevlar 49/epoxy beams and rings.** Reedy, E.D. Jr.; Guess, T.R. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 7p. (CONF-8810151—5). NTIS, PC A02/MF A01. Order Number DE89000637/JAW.

From JOWOG-28 meeting; Albuquerque, NM, USA (1 Oct 1988).

Kevlar 49/epoxy laminates often exhibit substantial material nonlinearity when subjected to bending. A unidirectionally reinforced Kevlar 49 lamina is nearly linear elastic to failure in tension, however, in fiber-directed compression, it responds in a perfectly plastic-like manner once a compressive strength of roughly 20% of its tensile ultimate strength is exceeded. This combined linear tensile/nonlinear compressive behavior is the source of Kevlar 49/epoxy's flexural nonlinearity. Since Kevlar 49 reinforced laminates can often carry bending loads well above those needed to cause initial compressive yield, it is desirable to be able to predict the post-yield flexural response. In this presentation, analyses that utilize a simple idealization of compressive yielding are described and calculated results for Kevlar 49 reinforced beams and rings are compared with available data. 2 refs., 3 figs.

57052 **(SAND—88-2722C) Effects of radiation on microelectronics and techniques for hardening.** Dressendorfer, P.V. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 16p. (CONF-881151—10). NTIS, PC A03/MF A01. Order Number TI89001227/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

Total dose damage, displacement damage, and single particle events can cause microelectronic circuits to cease to function properly. The tolerance of an integrated circuit to radiation damage can be affected by a large number of factors, including the irradiation conditions, postirradiation conditions, transistor characteristics, and circuit design. Improvements in hardness can be achieved by proper fabrication techniques (including minimization of gate oxide thickness, processing temperatures, and the use of hydrogen for MOS devices) and appropriate design considerations. 23 refs., 5 figs.

57053 **(UCRL—21120) Fabrication of hollow silica aerogel micospheres using droplet generation technique and sol-gel process.** Kim, N.K.; Kim, K.; Payne, D.A.; Upadhye, R.S. (Lawrence Livermore National Lab., CA (USA)). 3 Oct 1988. Contract W-7405-ENG-48. 18p. (CONF-881002—10). NTIS, PC A03/MF A01. Order Number DE89000673/JAW.

From 35. national vacuum symposium and 4th international laser science conference; Atlanta, GA, USA (2 Oct 1988).

A system was designed to produce hollow silica aerogel microspheres by combining a droplet generation technique and a sol-gel process. In the system, a simultaneous passage of an alkoxide solution and a fill gas through a dual-nozzle system found a continuous stream of hollow drops in the fluid state. The spherical drops were then levitated in a basic atmosphere to convert them into a rigid state by an accelerated reaction of condensation. A supercritical drying was adopted to drive off any remaining organic solvent in order to form porous aerogel spheres. 14 refs., 6 figs.

57054 **(UCRL—96189) Magnetic properties of dynamically compacted glassy metal powder cores.** Cline, C.F.; Hasegawa, R. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 10p. (CONF-881060—3). NTIS, PC A02/MF A01. Order Number DE89001125/JAW.

From HERAPS '88: international seminar on high energy working of rapidly solidified materials; Novosibirsk, USSR (10 Oct 1988).

The magnetic properties of interest include permeability, core loss, exciting power and B-H behavior which depend largely on the shape of the material. The powder material was made from glassy $Co_{68}Fe_4Ni_3B_{15}Si_{10}$ ribbon having a mass density 7.76 g/cm^3 and are in toroidal form having inside and outside diameter dimensions of 7.9 mm and 15.8 mm, respectively, and thickness of 9.5 mm. Effects of the conditions of dynamic compaction and post-fabricetion heat treatments on the magnetic properties are the main subject of the present investigation. 7 refs., 9 figs.

57055 **(UCRL—98370) Photonic applications of thin film GaAs grown on silicon and insulating substrates by Molecular Beam Epitaxy.** Morse, J.D.; McWright, G.M.; Mariella, R.P.; Behymer, E.M.; Guthreau, W.H. (Lawrence Livermore National Lab., CA (USA)). 1988. Contract W-7405-ENG-48. 8p. (CONF-8809123—1). NTIS, PC A02/MF A01. Order Number DE88016975/JAW.

From International congress on optical science and engineering; Hamburg, F.R. Germany (22 Sep 1988).

Thin film GaAs layers grown by Molecular Beam Epitaxy (MBE) on silicon, semi-insulating GaAs, and insulating substrates have been investigated for application to optoelectronic circuit technology. Photoconductivity measurements were conducted to characterize the electronic transport properties of the epitaxial layers in terms of carrier recombination lifetime and effective drift mobility. By varying the epitaxial growth parameters, it is possible to obtain various levels of material quality which are suitable for

various components of optoelectronic integrated circuits. Results from photodetectors fabricated from GaAs grown on various layers will be presented. The fabrication of ridge waveguides from GaAs grown on silicon dioxide will also be described. Finally, a procedure for growing high quality GaAs for active devices in situ with layers for picosecond photoconductors will be discussed. 5 refs., 6 figs.

57056 **(UCRL—99258) Impurity absorption coefficient measurements in phosphate glass melted under oxidizing conditions.** Sapak, D.L.; Ward, J.M.; Marion, J.E. (Lawrence Livermore National Lab., CA (USA)). 25 Jul 1988. Contract W-7405-ENG-48. 8p. (CONF-880887—17). NTIS, PC A02/MF A01. Order Number DE88016271/JAW.

From 32. international technical symposium on optical and opto-electronic applied sciences and engineering; San Diego, CA, USA (14 Aug 1988).

The contributions of individual impurities to the total absorption loss in phosphate laser glasses have been analyzed. In a previous study, small melts with intentional impurities were analyzed as a means of determining the absorption coefficients for specific impurities. Since that study, the conditions for melting of large castings of phosphate glass have been modified toward substantially higher oxygen fugacity so that microscopic platinum inclusions can be dissolved to prevent laser-induced damage. In this study, we present absorption coefficient measurements at the laser wavelength (1.05 μm) for most common transition metal impurities as well as platinum in phosphate laser glasses melted under the modern oxidizing conditions. 6 refs., 4 figs.

57057 **(UCRL—99554) A synthetic route to organic aerogels: Mechanism, structure, and properties.** Pekala, R.W.; Kong, Fung-Ming. (Lawrence Livermore National Lab., CA (USA)). 1988. Contract W-7405-ENG-48. 22p. (CONF-8809131—1). NTIS, PC A03/MF A01. Order Number DE88017112/JAW.

From 2. international symposium on aerogels; Montpellier, France (21 Sep 1988).

The base catalyzed, aqueous reaction of resorcinol with formaldehyde follows a sol-gel pathway in which surface functionalized polymer clusters are formed. The covalent crosslinking of these clusters produces gels which are dried under supercritical conditions to obtain low density, organic aerogels which are dried under supercritical conditions to obtain low density, organic aerosols (≦200 mg/cc). The aerosols are transparent and have cell sizes less than 1000 {angstrom}. Their microstructure consists of interconnected colloidal-like particles with diameters of 30-100 {angstrom}. The particle size, cell size, surface area, and density of resorcinol-formaldehyde (RF) aerogels are largely determined by the catalyst concentration in the mixture. RF aerogels are similar to silica aerogels in many ways, yet a comparison of their mechanical properties suggests subtle morphological differences. 24 refs., 12 figs.

57058 **(UCRL—99581) Direct machining of a non-axisymmetric phase corrector.** Schenz, R.F.; Patterson, S.R.; Saito, T.T. (Lawrence Livermore National Lab., CA (USA)). 8 Sep 1988. Contract W-7405-ENG-48. 17p. (CONF-880887—18). NTIS, PC A03/MF A01. Order Number DE89001222/JAW.

From 32. international technical symposium on optical and opto-electronic applied sciences and engineering; San Diego, CA, USA (14 Aug 1988).

One of the most challenging optical components to fabricate is a non-axisymetric part. We at Lawrence Livermore National Laboratory recently used the Large Optics Diamond Turning Machine, (LODTM), to make a part called a phase corrector. The Phase corrector is an annular optical component that is used to generate a known spectrum of time varying aberration. If the corrector has the proper distribution of spatial frequencies and amplitudes it will function correctly. Since the frequencies and amplitudes were the important requirement on the surface figure, the surface of the part was specified in the Fourier domain. A surface profile was generated from the spectrum which contained spatial frequencies as high as 40 cycles per revolution. The spatial frequency maps into a time domain frequency for the z-axis tool bar that is dependent on the spindle speed. At 40 cycles per revolution, any reasonable spindle speed taxes the band width limits of the z-axis tool bar. In order to decrease the errors in the surface figure due to machine dynamics, a technique for compensating for the dynamics in the Fourier domain was developed. The non-axisymetric phase corrector was directly machined out of brass on the LODTM. Test measurements of the surface figure were made with an LVDT on LODTM and compared to the commanded profile both in the spatial and frequency domains. The surface quality was measured with a Wyco Model 1000P surface analyzer. 15 figs.

57059 **Infrared characterization of UV laser-induced silicon oxide films.** Slaoui,-A.; Fogarassy, E.; White, C.W.; Siffert, P. (Centre de Recherches Nucleaires (IN2P3), Laboratoire Phase (UA du CNRS n° 292), 23, rue du Loess, 67037 Strasbourg Cedex, France). *Applied Physics Letters;* **53**: No. 19, 1832-1834(7 Nov 1988).

Oxygen incorporation and subsequent oxidation of ion-implanted silicon have been performed using repetitive pulsed excimer laser irradiation working in the liquid phase regime. The kinetics of the oxidation and the characterization of the grown SiO_2 were investigated by infrared spectroscopy. The origin of the broadening of the Si-O stretching band of these oxides grown from the liquid phase is discussed.

57060 **Salt smoke: The formation of submicron sized RbCl particles by thermal evaporation in 0.5—100 Torr of argon and helium.** Panitz, J.K.G.; Mattox, D.M.; Carr, M.J. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* **6**: No. 6, 3105-3110(Nov 1988).

We have shown that it is possible to form submicron-sized particles of a highly ionic compound RbCl by thermally evaporating the reagent salt in 0.5—100 Torr of inert gas. By collecting the particles on a surface and then carefully removing them, bulk powder can be collected. The ambient gas species, pressure, system geometry, and evaporation temperature profile affect the size and geometry of the particles which form. Evidence indicates that if strong convection currents are present during evaporation, the number of individual primary particles in the powder is increased and the number of sintered strings of primary particles is reduced. The primary particle size depends on the geometry of the evaporation source used and is independent of the ambient pressure. In argon, the size of the particles collected is independent of the distance between the collection plates and the source. In helium, the size of the primary particles collected from a single run can vary from ~10 to 1000 nm; the particle size collected is strongly dependent on the distance of the collection plates from the evaporation source.

57061 **Rainbow dust.** Crawford, F.S. (Physics Department and Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *American Journal of Physics;* **56**: No. 11, 1006-1009(Nov 1988).

Beautiful "rainbows" produced by tiny glass spheres are described.

57062 **Effects of substrate misorientation on the structural properties of CdTe(111) grown by molecular beam epitaxy on GaAs(100).** Reno, J.L.; Gourley, P.L.; Monfroy, G.; Faurie, J.P. (Sandia National Laboratory, Albuquerque, New Mexico 87185). *Applied Physics Letters;* **53**: No. 18, 1747-1749(31 Oct 1988).

CdTe (111) layers were grown by molecular beam epitaxy on oriented and misoriented GaAs (100) substrates. The layers were characterized by x-ray diffraction and photoluminescence microscopy. The results indicate that the CdTe layers grown on GaAs (100) misoriented 2° towards the [110] direction had peaks with full width at half-maximum up to four times narrower than either of the other orientations tested. Only threading dislocations were visible on this orientation by photoluminescence microscopy. These results indicate that the structural quality of CdTe grown on GaAs can be significantly improved by the use of an appropriately misoriented substrate.

57063 **Excimer laser induced oxidation of ion-implanted silicon.** Fogarassy, E.; White, C.W.; Slaoui, A.; Fuchs, C.; Siffert, P.; Pennycook, S.J. (Centre de Recherches Nucleaires (IN2P3), Laboratoire PHASE (ER du CNRS n° 292), 23, rue du Loess, F-67037 Strasbourg Cedex, France). *Applied Physics Letters;* **53**: No. 18, 1720-1722(31 Oct 1988).

We have investigated laser-induced oxidation of ion-implanted Si using a repetitively pulsed ArF laser, working at low-energy density (100—500 mJ/cm²). Oxidation is observed at energy densities between the melt threshold and that required for epitaxial recrystallization of the amorphous layer. At these energy densities, oxidation is not observed on virgin silicon. The factors that influence the oxidation process are discussed.

57064 **Surface-bonding geometry of (2 x 1)S/Ge(001) by the normal-emission angle-resolved photoemission extended-fine-structure technique.** Leung, K.T.; Terminello, L.J.; Hussain, Z.; Zhang, X.S.; Hayashi, T.; Shirley, D.A. (Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review [Section] B: Condensed Matter;* **38**: No. 12, 8241-8248(15 Oct 1988).

The surface structure of (2 x 1)S/Ge(001) was determined using the angle-resolved photoemission extended-fine-structure technique in the normal-emission direction. By comparison of the experimental data with curved-wave, multiple-scattering calculations, quantitative information about the local adsorption geometry was obtained. In particular, adsorption in a twofold bridge site, with a S-Ge bond length of 2.36 +- 0.05 A, was found. The twofold S bridge appears most likely to occur between two partially intact symmetric Ge-Ge dimers, with the Ge dimer laterally displaced by 0.10 +- 0.05 A from the bulk position. This result therefore provides evidence for S bonding to strong dangling bonds in the original dimers of the clean Ge(001) surface. There is, however, no evidence of significant surface contraction or expansion in the substrate layers, in contrast to the (2 x 2)S/Ge(111) case.

57065 **Molecular-dynamics simulation of cluster and atom deposition on silicon (111).** Biswas, R.; Grest, G.S.; Soukoulis, C.M. (Microelectronics Research Center, Iowa State University, Ames, Iowa 50011). *Physical Review [Section] B: Condensed Matter;* **38**: No. 12, 8154-8162(15 Oct 1988).

The deposition of Si atoms and Si-atom clusters on a silicon (111) surface has been studied with molecular-dynamics simulations using two- and three-body interatomic Si potentials. The energy deposition and dynamics of Si-atom deposition have been studied as a function of substrate temperature, incident atom energy, and substrate thickness. Epitaxial Si(111) layers have been grown by single-atom deposition. The energy deposition and spreading of Si-atom clusters is characterized as a function of substrate temperature, initial cluster velocity, cluster temperature, and cluster size. A range of deposition parameters has been characterized that lead to high spreading of clusters, a feature that is necessary for achieving epitaxial thin-film growth.

57066 **Azimuthally resolved optical second-harmonic generation from hydrogen on nickel (111).** Anderson, R.J.M.; Hamilton, J.C. (Sandia National Laboratories, P.O. Box 969, Livermore, California 94550). *Physical Review [Section] B: Condensed Matter;* **38**: No. 12, 8451-8454(15 Oct 1988).

We report the first azimuthally resolved measurements of the effect of an adsorbed gas on optical second-harmonic generation (SHG) from a clean, well-ordered metal surface. The second-harmonic intensity from Ni(111) decreases rapidly upon hydrogen adsorption; however, the threefold symmetry with sample rotation about the surface normal is retained. The β_1 and β_2 adsorption states are clearly resolved and their contributions to the second-order susceptibility are determined. For this system, SHG is highly sensitive to local site symmetry and little affected by long-range ordering of adsorbates.

57067 **(RFP-Trans—481) Process for production of stuffed or unstuffed glass using a sol-gel technique.** Hara, Koichi; Hate, Chiemi; Izumitani, Tetsuo. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). Sep 1988. Contract AC04-76DP03533. Translation of Japanese patent No. 62-70233, 1987. 6p. NTIS, PC A02/MF A01. Order Number DE88017039/JAW.

This invention relates to a technique for improving the methods of manufacturing stuffed or unstuffed glass by means of the sol-gel technique. Stuffed or unstuffed glass as understood here means glass into which desired stuffing components have been introduced or from which desired unstuffing components have been extracted. It is characterized by the use of silicon alkoxides alone or in a mixture with other metal alkoxides to make a wet gel preform, after which the desired components are stuffed or unstuffed and the gel is dried and sintered.

57068 **(RFP-Trans—483) Supports for fixation or adsorption.** Mizuguchi, Hiroyoshi; Kobayashi, Toshinari. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant; Shimazu Seisakusho Co. Ltd., Kyoto (Japan)). Sep 1988. Contract AC04-76DP03533. Translated from Japanese Kokai Patent Sho 62-279840 (1987). 10p. NTIS, PC A02/MF A01. Order Number DE88017233/JAW.

Supports for fixation or adsorption consisting of nitrogen-containing porous glass formed by the heat treatment of porous gel under ammonia gas, the said porous gel being produced by hydrolysis of metal alkoxides and/or metal alkyl alkoxides. As supports for affinity chromatography, organic polymers of polysaccharides (e.g., agarose, etc.), molten glass, alkoxide glass and silica gel are generally used. 2 figs.

57069 **Electron-donor dopant, method of improving conductivity of polymers by doping therewith, and a polymer so treated.** Liepins, R.; Aldissi, M. (to Dept. of Energy, Washington, DC). US Patent 4,755,326. 5 Jul 1988. Filed date 27 Jul 1984. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

The electrically conductive material is described comprising a polymer with a conjugated backbone selected from the group consisting of polyacetylene, polypyrrone, and polyphenylquinoxaline, the polymer being electron-donor doped to a controlled degree with an agent derived from an electride dopant or a dopant derived from an alkalide both of which contain a trapping agent being selected from the group consisting of: a crown ether, 1,4,7,10,13,16-hexaoxacyclooctadecane, cryptand, methyl ether cyclodextrin, spherand, methyl ether calixarene, podand, and an octopus molecule, the agent being made in the presence of lithium.

57070 **(LA-tr—88-23) Production methods of graphite whiskers.** Shigata, M. (Kureha Chemical Industry Co. Ltd., Tokyo (Japan)). 1988. Contract W-7405-ENG-36. Translation of Japanese Patent No. 58-110493 (1983). 14p. NTIS, PC A03/MF A01. Order Number DE88017038/JAW.

Graphite whiskers are made by: first vaporizing an aromatic ring organic compound or a mixture of it which contains donative hydrogen; then diluting and mixing it into an inert gas or a mixture of inert gas and active gas; placing it in a reactor which is heated to 800- 2000{degree}C; then letting the carbon fiber to grow to a certain length using, as a nucleus, the element of VIII group or Vb group in the periodic table, or the fine powder of the compound of them, which is placed on a substrate; next, letting the fiber to get fat to the certain thickness by increasing the consistency and temperature; and then graphitizing the fiber in the inert atmosphere by heat treating at over 2000{degree}C. 1 tab.

57071 **Electrically conductive alternating copolymers.** Aldissi, M.; Jorgensen, B.S. US Patent Application 6-091,927. 31 Aug 1987. 11p. Contract W-7405-ENG-36. NTIS, PC A03/MF A01.

Polymers which are soluble in common organic solvents and are electrically conductive, but which also may be synthesized in such a manner that they become nonconductive. Negative ions from the electrolyte used in the electrochemical synthesis of a polymer are incorporated into the polymer during the synthesis and

serve as a dopant. A further electrochemical step may be utilized to cause the polymer to be conductive. The monomer repeat unit is comprised of two rings, a pyrrole molecule joined to a thienyl group, or a furyl group, or a phenyl group. The individual groups of the polymers are arranged in an alternating manner. For example, the backbone arrangement of poly(furylpyrrole) is -furan-pyrrole-furan-pyrrole- furan-pyrrole. An alkyl group or phenyl group may be substituted for either or both of the hydrogen atoms of the pyrrole ring.

57072 **Process for introducing electrical conductivity into high-temperature polymeric materials.** Liepins, R.; Jorgensen, B.S.; Liepins, L.Z. US Patent Application 6-091,251. 27 Aug 1987. 11p. Contract W-7405-ENG-36. NTIS, PC A03/MF A01.

High-temperature electrically conducting polymers. The in situ reactions: $AgNO_3 + RCHO \rightarrow Ag^0 + RCOOH$ and $R_3M \rightarrow M^0 + 3R$, where M = Au or Pt have been found to introduce either substantial bulk or surface conductivity in high- temperature polymers. The reactions involving the R_3M were caused to proceed thermally suggesting the possibility of using laser means for initiating such reactions in selected areas or volumes of the polymeric materials. The polymers successfully investigated to date are polyphenylquinoxaline, polytolylquinoxaline, polyquinoline, polythiazole, and pyrrone. 3 tabs.

57073 **Method for fabricating light weight carbon-bonded carbon fiber composites.** Wrenn, G.E. Jr.; Abbatiello, L.A.; Lewis, J. Jr. US Patent Application 6-063,059. 17 Jun 1987. 12p. Contract AC05-84OS21400. NTIS, PC A03/MF A01.

The invention is directed to the fabrication of ultralight carbon- bonded carbon fiber composites of densities in the range of about 0. 04 to 0.10 grams per cubic centimeter. The composites are fabricated by forming an aqueous slurry of carbonaceous fibers which include carbonized fibers and 0-50 weight percent fugitive fibers and a particulate thermosetting resin precursor. The slurry is brought into contact with a perforated mandrel and the water is drained from the slurry through the perforations at a controlled flow rate of about 0. 03 to 0.30 liters per minutes per square inch of a mandrel surface. The deposited billet of fibers and resin precursor is heated to cure the resin precursor to bind the fibers together, removed from the mandrel, and then the resin and fugitive fibers, if any, are carbonized.

57074 **Improved polymeric surface for adhesion through electron stimulated chemical modification of polymeric surface.** Kelber, J.A. US Patent Application 6-036,039. 8 Apr 1987. 10p. Contract AC04-76DP00789. NTIS, PC A02/MF A01.

Treating polymer surfaces, e.g., Teflon, particularly very thin surfaces, e.g., 50-10,000 A, with low energy electron radiation, e.g., 100-1000 eV, in a high vacuum environment, e.g., less than 10 /sup {minus}6/ Torr, to enhance the ability of the surface to be adhered to a variety of substrates.

40 CHEMISTRY

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 56190, 56206, 57007, 57139, 57233, 57278, 57417, 57452, 57757, 58247

57075 **(CEA-CONF—9400) Hydrogen isotope analysis by high resolution mass spectrometry at the Bruyere-le-Chatel Center. Comparison of mass spectrometers VG 3001 and MAT 271.** Dall'Ava, D.; Guidon, H.; Claudon, X. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France)). 1987. 15p. (In French). (CONF-8710386—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754986/JAW.

From Workshop on mass spectrometry; Marcoule, France (22 Oct 1987).

The determination of hydrogen isotopes and of the ratio T/D in a gaseous mixture is examined. Calibration is obtained by accurate standards obtained by different mixtures T/sub 2/ + D/sub 2/ for a precision of 0.1 %. Performance of the two spectrometers used are compared.

57076 **(CEA-CONF—9427) Mass spectra of alkaline earth salts with a FAB source. Complexation with crown ethers.** Ulrich, J. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). 1987. 13p. (In French). (CONF-8709132—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754988/JAW.

From 6. international conference on secondary ion mass spectrometry - SIMS VI; Versailles, France (13 Sep 1987).

With a liquid desorption FAB source it is possible to obtain alkaline earth metal ions complexed by a crown ether. Conditions for formation of these complexes ions are examined for selection of the complexing agent in function of cation size. Behaviour of alkaline and alkaline earth compounds are compared allowing the differentiation of ion extraction phenomena by liquid desorption ion source and solvent extraction.

57077 **(CEA-CONF—9428) Calibration of a tracer Am 243 by determination of radiogenic Pu 239 in function of time.** Eliot, E.; Louis, C.; Lucas, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). 1987. 7p. (In French). (CONF-8709132—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88754989/JAW.

From 6. international conference on secondary ion mass spectrometry - SIMS VI; Versailles, France (13 Sep 1987).

A solution of Am 243, containing U 233 as isotopic dilution tracer, is used for Am determination in spent fuel solutions. U 233 allows the monitoring of evaporation rate of the solution by isotopic dilution with natural uranium. The method uses the determination of Pu 239 in the solution by isotopic dilution with thermionization mass spectrometry.

57078 **(CEA-CONF—9445) Continuous monitoring of methyl iodide purity and content in the gas feeding the trapping pilot plant.** Charrier, G. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France)). 1988. 20p. (In French). (CONF-8803154—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754991/JAW.

From CATAMA meeting; Cadarache, France (10 Mar 1988).

An analysis method is developed for inspection of solid traps for gaseous iodine. Methyl iodide injected in the traps is determined by gas chromatography. Contents of 50 ppm in volume are measured. Labelling with iodine 123 allows a better sensitivity, 4 refs, 5 figs, 6 tables.

57079 **(CEA-CONF—9463) Determination of boride stoichiometry by coupling spark generator and plasma emission spectrometry.** David, P.; Fieni, J.M. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France)). 1988. 5p. (In French). (CONF-880108—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88754993/JAW.

From Winter conference on plasma spectrochemistry; San Diego, CA, USA (3 Jan 1988).

Metallic borides are often difficult to put into solution. An apparatus is described for direct analysis of the solid generating aerosols by sparks. Accuracy of 2-3 % are obtained, the method is fast and samples or standards can be stored.

57080 **(CONF-8810112—2) New methods of separation and assay of some radionuclides of environmental interest.** McDowell, W.J.; Case, G.N. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01. Order Number DE88016365/JAW.

From 34. annual conference on bioassay, analytical and environmental radiochemistry; Las Vegas, NV, USA (17 Oct 1988).

In fundamental solvent extraction research at Oak Ridge National Laboratory a large number of systems have been discovered that are selective for one or a few elements. Some of these have been adapted to analytical separation and assay. To serve our own need for highly reproducible and accurate analysis of samples con-

taining α and β-emitting nuclides, we have turned to liquid scintillation in both its familiar β-liquid scintillation (β-LS) form and in a less-familiar development called Photon-Electron Rejecting Alpha Liquid Scintillation (PERALS) spectrometry. β counting by the former and α counting by the latter combined with appropriate separation method result in powerful tools for radioassay of a wide range of sample types. 15 refs.

57081 **(DOE/ER/13473—3) Chemistry of bimetallic and alloy surfaces: Progress report for period February 1, 1986--January 31, 1989.** Koel, B. (Colorado Univ., Boulder (USA)). Oct 1988. Contract FG02-86ER13473. 12p. NTIS, PC A03/MF A01. Order Number DE89002066/JAW.

We have investigated the following major areas important to understanding bimetallic and alloy surface chemistry and catalysis: (1) the influence of potassium on the interactions of ethylene and other hydrocarbon species with platinum, (2) the determination of ensemble size requirements for adsorption and reaction on platinum surfaces, (3) the influence of oxygen adatoms on the bonding of nitric oxide to platinum, and (4) the role of the electronic structure of the metal surface in controlling surface chemistry. All of these studies were carried out using surface science techniques on well-characterized metal surfaces. The specific systems studied were chosen to discriminate among and elucidate the various factors responsible for the altered properties and chemistry of bimetallic surfaces. 11 refs.

57082 **(FMPC—2121) The simultaneous photometric determination of nitrate, nitrite, and phosphate in biodenitrification liquors by automated analysis.** Stoeckel, J.J.; Werdmann, J.F. (Westinghouse Materials Co. of Ohio, Cincinnati (USA). Feed Materials Production Center). Oct 1988. Contract AC05-86OR21600. 40p. NTIS, PC A03/MF A01. Order Number DE89001033/JAW.

An automated procedure for the simultaneous photometric determination of nitrate, nitrite, and phosphate in biodenitrification reactor liquors using an ALPKEM Rapid Flow Analyzer has been developed for application as a process control analytical method. 16 refs., 4 figs., 5 tabs.

57083 (IAEA-TECDOC—464, pp 105-110) **Analysis of boron, samarium and gadolinium in rock samples by neutron capture gamma ray spectrometry.** Tittle, C.W.; Glascock, M.D. (Southern Methodist Univ., Dallas, TX (USA). Dept. of Physics; Missouri Univ., Columbia (USA). Research Reactor Facility). Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704190/JAW. (CONF-8711234—).

From Consultants' meeting on current trends in nuclear borehole logging techniques for elemental analysis; Ottawa, Canada (2 Nov 1987).

Prompt gamma neutron activation analysis (PGNAA) is useful for determining many of the elements found in sedimentary rocks. It is particularly suitable for the trace elements boron, samarium and gadolinium. The sensitivity of detection can be of the order of 0.1 part per million with an adequate neutron source. Twenty-five sedimentary rock samples were analyzed in the PGNAA facility at the University of Missouri Research Reactor. The materials included Ottawa sand, Berea sandstone, Royer dolomite and several other formations of interest in the petroleum industry. Results of the analyses are presented. Correlations of gadolinium and samarium and of boron with the sum of samarium and gadolinium are given. (author). 8 refs, 2 figs, 4 tabs.

57084 (IAEA-TECDOC—464, pp 111-121) **Monte Carlo Library Least-Squares Analysis principle for borehole nuclear well logging elemental analyzers.** Verghese, K.; Gardner, R.P.; Mickael, M.; Shyu, C.M.; He, T. (North Carolina State Univ., Raleigh (USA). Dept. of Nuclear Engineering). Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704190/JAW. (CONF-8711234—).

From Consultants' meeting on current trends in nuclear borehole logging techniques for elemental analysis; Ottawa, Canada (2 Nov 1987).

Monte Carlo simulation is an ideal way to generate the spectral response of well logging tools which are based on the (n,γ) technique. The primary use of Monte Carlo models in the past has been in the calibration of tools and log interpretation. Recently, it has been recognised that Monte Carlo simulation can also be used directly for the analysis of elemental composition. This new analysis principle combines the power of Monte Carlo for accurate simulation of the spectrum of each of the elements that are present in the formation with the linear library least-squares method for the determination of elemental amounts. The methodology of Monte Carlo - Library Least Squares Analysis is based on the following procedure: (1) for an assumed composition of the formation, generate the complete spectral response by Monte Carlo, (2) within the program, keep track of the individual spectral responses for each element, (3) using the library least-squares analysis method, calculate the elemental amounts in the formation using the measured spectrum of that formation and the individual elemental spectra from the Monte Carlo simulation as the library standards, and (4) if the elemental amounts calculated in step 3 are not close enough to those assumed in step 1, repeat steps 1 through 3 using an assumed composition that is closer to that of the formation. Preliminary results from the application of this method to X-ray and neutron capture gamma-ray spectra show considerable promise and can be adapted for elemental composition analysis using spectral nuclear logging tools. (author). 14 refs, 5 figs, 2 tabs.

57085 (IAEA-TECDOC—464, pp 123-133) **Advances in bulk elemental analysis using neutron interactions.** Gozani, T. (Science Applications International Corp., Sunnyvale, CA (USA)). Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704190/JAW. (CONF-8711234—).

From Consultants' meeting on current trends in nuclear borehole logging techniques for elemental analysis; Ottawa, Canada (2 Nov 1987).

Recent advances in on-line bulk elemental analysis using nuclear interactions with thermal and fast neutrons are reviewed. Three aspects of the advances are emphasized: very high count-rate gamma ray spectroscopy that maintained the energy fidelity, presence of discrete and continuum gamma rays in high energy region resulting from 14 MeV neutron interactions, and advanced data analysis incorporating a-priori knowledge. (author). 5 refs, 9 figs, 1 tab.

57086 (IAEA-TECDOC—464, pp 135-152) **Assay of gold and platinum in rocks and ores - an option.** Clayton, C.G. (Tregaron, Dyfed (UK)). Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704190/JAW. (CONF-8711234—).

From Consultants' meeting on current trends in nuclear borehole logging techniques for elemental analysis; Ottawa, Canada (2 Nov 1987).

Since the low concentrations of gold and platinum in prospective ore bodies inhibit the effective use of neutron techniques in borehole logging equipment, consideration has been given to the routine use of activation analysis for multiple sample assay at ground level for the purpose of establishing the viability of a prospective ore body. The potential of small electron and proton Linacs are discussed and it is shown that electron Linacs can be regarded as the origin of a relatively intense source of thermal neutrons and the proton Linac as a source of fast neutrons of identified maximum energy. The possibility of analysing 2 to 3 kg samples of gold and platinum at the ppm level is discussed and particular consideration is given to self-shielding effects in gold when using thermal neutrons. This problem is resolved by using the proton Linac and fast neutron activation analysis. (author). 8 refs, 16 figs, 2 tabs.

57087 **(INIS-BR—1165) Electrodisintegration of /sup 232/Th by neutron emission.** Terremoto, L.A.A. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1986. 84p. (In Portuguese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88703567/JAW.

The one neutron decay of the giant electric quadrupole resonance was studied by means of electrodisintegration and photodisintegration reactions. The separation of the multipole components of the photonuclear cross section σ/sub γ,n/(E) in /sup 232//sub 90/Th was also performed. The /sup 232/Th(e,n)/sup 231/Th cross section and the /sup 232/Th(B,n)/sup 231/Th bremsstrahlung yield

were measured in the incident electron energy range 8-60 MeV and 25-60 MeV, respectively. These measurements have been performed using the electron beam of the Linear Accelerator of the IFUSP and the experimental technique of activation analysis. The virtual photon spectra corrected for nuclear finite size in the analysis of the experimental data obtained in order to separate the multipole components of the photonuclear cross section, was used. An electric dipole component σ/sup EL//sub γ,n/(E) that exhausts (60+-7)% of the El sum rule (integrated uσ to 16,5 MeV) was shown. This result is in agreement with the one Obtained in experiments where monoenergetic photons were used. An electric quadrupole component σ/sup E2//sub γ,n/(E) whose value corresponds to (32+-6)% of the E2 sum rule, was also obtained.

57088 (INIS-BR—1229, pp 16) **Measurement of the carbon content of silicate glasses by use of the /sup 12/C(d,p/sub 0/) /sup 13/C reaction.** Fine, G.J.; Stolper, E.M.; Mendenhall, M.H.; Livi, R.P.; Trombello, T.A. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57089 (INIS-BR—1229, pp 23) **Comparison of several nuclear reaction techniques for hydrogen depth profiling in solids.** Xiong, F.; Rauch, F.; Chi, C.; Tombrello, T.A.; Livi, R.P. (California Inst. of Tech., Pasadena (USA); Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57090 (INIS-BR—1229, pp 28) **Hydrogen depth profiling in solids: a comparison of several resonant nuclear reaction techniques.** Xiong, F.; Tombrello, T.A.; Rauch, F.; Livi, R.P.; Zhou, Z. (California Inst. of Tech., Pasadena (USA); Frankfurt Univ. (Germany, F.R.). Inst. fuer Kernphysik; Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Fudan Univ., Shangai (China)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57091 (INIS-mf—11263, pp 191-200) **Application of X-ray fluorescence method in determination of elements in rocks.** Machacek, V. (Geoindustria, Prague (Czechoslovakia)). 1987. (In Czech). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88704145/JAW. (CONF-8710342—).

From Mining Pribram in science and technology; Pribram, Czechoslovakia (12 Oct 1987).

The detection limit and the determinability limit are discussed of X-ray fluorescence analysis (XFA). Various methods are presented of sample preparation for measurement, and conditions of measurement are described. Briefly described are the basic methods of trace element determination using the XFA method, namely the external standard method, the standard addition method and the internal standard method. The differences are explained between dispersive and energy dispersive XFA. (E.S.). 2 figs.

57092 (INIS-mf—11263, pp 201-214) **X-ray spectral analysis of waste products from treatment of some polymetallic ores.** Burian, M. (Ustav pro Vyzkum Rud, Mnisek pod Brdy (Czechoslovakia)). 1987. (In Czech). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88704145/JAW. (CONF-8710342—).

From Mining Pribram in science and technology; Pribram, Czechoslovakia (12 Oct 1987).

The method of X-ray spectral analysis was used for determining copper, lead, zinc and sulfur in samples from the localities of Zlate Hory East, Zlate Hory West, Horni Benesov and Banska Stiavnica. The samples were measured in form of pellets 400 mm in diameter. For the measurement, a flow proportional counter was used and all measurements were made in a vacuum of ca 4 to 7 Pa. The results of the determination of copper, lead, zinc and sulfur for all localities are tabulated and compared with the results of a chemical analysis. (E.S.). 7 refs., 8 tabs.

57093 (INIS-mf—11263, pp 59-68) **Combined analyzer of uranium, free acid and nitrate ions.** Batik, J.; Jaros, J.; Radil, V. (Vyvojovy Zavod Uranoveho Prumyslu, Zbraslav nad Vltavou (Czechoslovakia). Ustav Jadernych Paliv). 1987. (In Czech). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88704145/JAW. (CONF-8710342—).

From Mining Pribram in science and technology; Pribram, Czechoslovakia (12 Oct 1987).

The analyzer consists of an analytical and an electronic units. A detailed description is presented of both units. The analyzer uses a PMD 85 microcomputer. The basic functions of the analyzer were tested such as the accuracy of sampling, the reproducibility of determinations and reliability in long-term operation. In the uranium concentration range of 0.5 to 80 mg/l U, free acid of 5 to 100 g/l H/sub 2/SO/sub 4/, nitrate ions of 10 to 100 g/l NO/sub 3//sup -/, the coefficient of correlation for the individual determinations was found to be better than 0.999. The reproducibility of determinations was better than 3% rel. (E.S.). 1 ref., 2 figs.

57094 **(IPEN-Pub—126) Study of the determination of molybdenum in geological materials by neutron activation analysis.** Miura, E.M.; Saiki, M. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Oct 1987. 10p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703588/JAW.

The determination of molybdenum in geological materiais by instrumental neutron activation analysis frequently does not present results due to spectral interferences of radioisotopes and due to / sup 99/Mo produced by fission of uranium. In order to eliminate interfering elements such as Na, Fe, U and lanthanides a chemical separation procedure was studied using and anionic exchange resin. In this separation, a recovery of (93+-3%) of Mo was obtained and pratically all the uranium was found in the effluent. Activation with epithermal neutrons reduced the interferences mainly those originating from uranium. Interference factors of 0.84 μg Mo/μg U and 0.038μg Mo/μg U, respectively for thermal and epithermal irradiations, were determined experimentally. The separation method applied to the analysis of synthetic samples containing /sup 141/Ce and /sup 59/Fe interferents presented results with a precision of 6.9% and relative error of 2.6%. Analysis of Mo was also carried out in two international geological samples (AGV-1 and BCR-1) and in a sample of volcanic rock from Pocos de Caldas, MG Brazil. A sensitivity of 0.014γ of Mo was attained by this method in the absence of interferering elements.

57095 **(KFK—4415) Enrichment and stripping voltametric behavior of technetium traces at a carbon paste electrode modified with TTA.** Dick, R.; Ruf, H.; Ache, H.J. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Radiochemie; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfallbehandlung). Jun 1988. 20p. (In German). (PWA—9/88). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755185/JAW.

The possibility of enrichment as well as the stripping voltammetric behavior of technetium traces at a carbon paste electrode modified with thenoyltrifluoroacetone (TTA) was studied. Accumulation of Tc(IV) on the electrode surface occurs without application of a deposition voltage due to complex formation with TTA, probably resulting Tc(TTA)/sub 4/. During the following cathodic potential scan made with the differential pulse mode a characteristic current peak is obtained at -40 mV (vs. Ag/AgCl) which increases with Tc concentration and deposition time. However, Tc(IV) gives much more sensitive stripping current signals if a reductive deposition potential of -0.4 V is applied, presumably on account of the formation of Tc(TTA)/sub 3/. In this case an anodic voltammetric scan was applied resulting a stripping peak at about +30 mV, the height of which is related to the concentration of Tc in solution as well as to the time of deposition. Calibration graphs revealed good reproducibility for analytical application. The lower detection limit for Tc(IV) achieved for 1 M sodium chloride solutions 4.6 x 10/sup -9/M. Tc(VII) is not enriched in the absence of reduction which takes place only from about -0.6 V on with the pH optimally set at 3.5. Therefore it is basically possible to discriminate Tc(IV) from Tc(VII).

57096 **(PB—88-232541/XAB) Lithium and its recovery from low-grade nevada clays. Bulletin.** Crocker, L.; Lien, R.H. (Bureau of Mines, Salt Lake City, UT (USA). Salt Lake City Research Center). 1987. 46p. (BM-B—691). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600197.

Processes were investigated for recovering a marketable lithium product from the montmorillonite-type clays of the McDermitt caldera. Limestone-gypsum roasting and selective chlorination proved most successful for extracting lithium from the clays; 80-pct Li recovery was achieved using either technique. With both processes, lithium silicate in the clay was converted to a water-soluble compound - either lithium sulfate or lithium chloride. The lithium was then recovered as a carbonate by water leaching the calcine, concentrating the leach solution by evaporation, and precipitating the lithium with soda ash.

57097 **(PINSTECH/NCD—110) Trace enrichment with activated carbon and determination of Ni, Hg, Sn and Cd using diethyldithiocarbamate as complexant by atomic emission spectrography (AES).** Rehana, I.; Qureshi, I.H. (Pakistan Inst. of Nuclear Science and Technology, Islamabad (Pakistan). Nuclear Chemistry Div.). Jul 1987. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704401/JAW.

A methods has been developed for the preconcentration and determination of trace amounts of Hg, Ni, Sn and Cd in aqueous solutions. The complexes of these elements with sodium diethyl dithiocarbamate were adsorbed on activated charcoal and determined by atomic emission spectrography d-c arc technique. Factors which affect the quantitative recovery of the microamounts of the elements were optimised. Pd was used as an internal standard. The detection limits ranged from 0.01 to 0.05 ppm. 2 fig.

57098 **(SAND—88-1149) Manual of analytical methods for the Environmental Health Chemistry Laboratory.** Greulich, K.A.; Gray, C.E.; Kelly, B.M. (Sandia National Labs., Albuquerque, NM (USA)). May 1988. Contract AC04-76DP00789. 209p. NTIS, PC A10/MF A01. Order Number DE89001008/JAW.

This manual is compiled from techniques used in the Environmental Health Chemistry Laboratory of Sandia National Laboratories in Albuquerque, New Mexico. The procedures are similar to those used in other laboratories devoted to Environmental Health practices. Some of the methods are standard; some, modified to suit our needs; and still others, developed at Sandia. The authors have attempted to present all methods in a simple and concise manner but in sufficient detail to make them readily usable. It is not to be inferred that these methods are universal for any type of sample, but they have been found very reliable for the types of samples mentioned. The authors welcome inquiry for clarification of any part of this manual. We hope that the document will be of use and service to others.

57099 **New modes of quasi-periodic combustion near a degenerate hopf bifurcation point.** Margolis, S.B.; Matkowsky, B.J. (Combustion Research Facility, Sandia National Labs., Livermore, CA (US)). *SIAM Journal on Applied Mathemadics;* **48**: No. 4, 828-853(Aug 1988).

Steady, planar propagation of a condensed phase reaction front is unstable to disturbances corresponding to pulsating and spinning waves for sufficiently large values of a parameter related to the activation energy. This paper considers the nonlinear evolution equations for the amplitudes of the pulsating and spinning waves in a neighborhood of a double eigenvalue of the problem linearized about the steady, planar solution. In particular, near a degenerate Hopf bifurcation point, closed branches of solutions which represent new quasi-periodic modes of combustion are described.

57100 **Freeze chromatography method and apparatus.** Scott, C.D. US Patent Application 6-039,130. 16 Apr 1987. 13p. Contract AC05-84OR21400. NTIS, PC A03/MF A01.

A freeze chromatography method and apparatus are provided which enable separation of the solutes contained in a sample. The apparatus includes an annular column construction comprising cylindrical inner and outer surfaces defining an annular passage therebetween. One of the surfaces is heated and the other cooled while passing an eluent through the annular passageway so that the eluent in contact with the cooled surface freezes and forms a frozen eluent layer thereon. A mixture of solutes dissolved in eluent is passed through the annular passageway in contact with the frozen layer so that the sample solutes in the mixture will tend to migrate either toward or away the frozen layer. The rate at which the mixture flows through the annular passageway is controlled so that the distribution of the sample solutes approaches that at equilibrium and thus a separation between the sample solutes occurs. 3 figs.

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REFER ALSO TO CITATION(S) 56019, 56020, 56028, 56111, 56138, 56183, 56199, 56283, 56507, 56677, 56984, 57012, 57020, 57024, 57032, 57053, 57127, 57137, 57467, 57616, 58274

57101 **(CONF-881031—15) Measurements of adsorption in the $LiAlO_2$-H_2O(g) system.** Fischer, A.K.; Johnson, C.E. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 8p. NTIS, PC A02/MF A01. Order Number DE89000529/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

Isotherms are presented for adsorption of H_2O(g) on $LiAlO_2$at 573, 623, and 873K. From these data, isobars and isosteres were derived. Together with earlier data for 673 and 773K, the new data suggest that two adsorption processes are involved: physisorption at 573K and below, and chemisorption at 873K and above. Both processes function in the intervening temperature range. Corrections were applied to the raw adsorption data from the breakthrough technique for postbreakthrough uptake of H_2O(g). Adsorption on non-BET surfaces is believed to be involved in these corrections for the lower temperature isotherms. 7 refs., 4 figs.

57102 (INIS-SU—16/A, pp 83-85) **Stability and electrocatalytic activity of the oxo-bridged dimer ((BPY)/sub 2/(H/sub 2/O)RuORu(H/sub 2/O)(BPY)/sub 2/)/sup 4+/ in basic solutio ns.** Kutner, W.; Tomaszewski, A.; Gilbert, J.A.; Meyer, T.J.; Royce, W.M. 1986. NTIS (US Sales Only), PC A22/MF A01. Order Number DE88780186/JAW. (CONF-8608152—).

From 37. meeting of the International Society of Electrochemistry; Vilnius, USSR (1 Aug 1986).

The stability and electrocatalytic activity of the Ru-oxo-bridged dimer ((bpy)/sub 2/(H/sub 2/O)RuORu(OH/sub 2/)(bpy)/sub 2/)/sup 4+/, (bpy=2,2'-dipyridine) with respect to some organic substrates (maleic acid, 2-propanol, benzyl alcohol, etc.) were determined at $13 \leqq pH \leqq 14$. The rate of proton dissociation from ((bpy)/sub 2/(HO)Ru/sup 3+/(ORu)/sup 4+/(OH)(bpy)/sub 2/)/sup 3+/, taking place prior to the electrocatalytic step, was studied and its role limiting the overall process was evaluated. 1 ref.; 1 fig.

57103 **(LBL—25834) Electron transfer in Bis([8]annulene)f-element systems.** Eisenberg, D.C. (Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC03-76SF00098. 121p. NTIS, PC A06/MF A01. Order Number DE89000555/JAW.

The rate of electron exchange between potassium bis(t,butyl[8]- annulene)ytterbate(II) and potassium bis(t-butyl[8]annulene)- ytterbate(III) has been measured by NMR line broadening techniques. Electron exchange studies have been extended to uranium, neptunium, and plutonium systems. This involved the first isolation and thorough characterization of the reduction product of uranocene. Bis(t,butyl[8]annulene) compounds were prepared for neptunium III and IV and for plutonium III and IV. The ^1H NMR spectra of all of these compounds are reported. In all of these systems electron exchange occurs on the ^1H NMR time scale. The ability or inability to freeze out the exchange in the different systems is consistent with the rate and mechanism observed in the ytterbium system. The reduction of biuranocenylene is reported, as are the x-ray crystal structures for potassium bis([8]annulene)ytterbate(III) and potassium bis(methyl[8] annulene)uranate(III). Comparison of these structures with previously solved ytterbium(II) and uranium(IV) bis([8]annulene) struc-

tures allows for determination of the effect of oxidation state of the central metal on structure.

57104 **(LBL—25860) Preparation and characterization of graphite fluorometallate salts and graphite fluorides by chemical and electrochemical methods.** Lerner, M.M. (Lawrence Berkeley Lab., CA (USA)). 1 Sep 1988. Contract AC03-76SF00098. 131p. NTIS, PC A07/MF A01. Order Number DE89000274/JAW.

Graphite intercalation compounds of main-group metal fluorides are prepared utilizing Cl_2 as an oxidizing agent. The action of Cl_2 with GeF_4 and Cl_2/HF with either PF_5 or BF_3 on graphite produces fluorometallate salts. The relationship between the calculated enthalpy change for the reduction half-reaction and degree of intercalation is discussed. The electrochemical oxidation of graphite in 49% aqueous HF generates, at the oxidation limit, a 2nd stage graphite fluoride with a charge on carbon of C/sub 10{minus}14// sup {plus}/. The fully-oxidized product is a 2nd stage analog of the planar-sheet graphite fluorides produced by the chemical or electrochemical fluorination of graphite in liquid anhydrous hydrogen fluoride (AHF). The fluorometallate salts prepared by electrochemical oxidation of graphite in an AHF/alkali metal fluorometallate salt (M = As, P, B, Sn) electrolyte are examined. The chemical fluorination of 2nd- and 3rd-stage C/sub x/AsF_6 salts with AHF/F_2 at ambient temperature produces a planar-sheet graphite fluoride phase with a C/F ratio as low as 1.3 along with a C/sub x/AsF_6 phase. The reaction of graphite with AHF/SnF_4/F_2 results in the rapid disappearance of SnF_4, F_2 uptake, and color change of the solid from grey to blue-black. Graphite reacts with AHF/K_2MnF_6 in a stoichiometric ratio of at least 1 Mn for 6 C to produce MnF_3 and a C/sub x/F phase. The reaction of excess PF_5 with a well-evacuated C/sub x/BF_4 {center dot} δBF_3 salt yields partial displacement of BF_3. When PF_5 {plus} HF are employed, no BF_3 is displaced from the fluoroborate salt. 21 refs., 15 figs., 18 tabs.

57105 **(NAGRA-NTB—83-09) Investigations to the sorption behaviour of Cs-137 and Sr-90 in different rock/solution-systems.** Laske, D.; Caflisch, C.; Wiedemann, K.H. (2314000CH). (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Oct 1983. 110p. (In German). Nagra, CH-5401 Baden, Switzerland.

In order to estimate the rate of transport of nuclides in the event of water penetration into an ultimate underground repository for radioactive waste, knowledge of the sorption capability of the surrounding rocks is needed. The sorption behaviour of caesium-137 and strontium-90 on powder samples of generic types of 3 clays, 2 sulphate rocks, 6 crystalline rocks, and 2 fissure minerals in different rock-specific waters has been investigated in batch experiments. The nuclide distribution coefficients determined describe the distribution of the nuclide among the solid and the liquid phase of the batch under conditions which may occur at the rock as well as in the water during migration. Of the experimental parameters ion strength of the solution, temperature, initial radioactivity of the solution, rock/solution ratio of the batch the ion strength exerts the greatest influence. In general, the nuclide sorption at the rock decreases with increasing ion strength of the carrier solution. The sorption of strontium is within the same order of magnitude in comparable waters on all the rocks investigated. The sorption capability of caesium is, by some orders of magnitude, higher on clays, mylonite and chlorite than that of strontium. The sorption behaviour of caesium on clays and crystalline rocks is somewhat different according to their origin. (author) 15 refs., 46 figs., 9 tabs.

57106 **(NAGRA-NTB—88-24) Chemical behaviour of montmorillonite in the backfill material of a final repository.** Grauer, R. (Paul Scherrer Institut, Wuerenlingen (Switzerland)). (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Jul 1988. 81p. (In German). Nagra, CH-5401 Baden, Switzerland.

With a view to supplementing an earlier report (NTB 86-12, EIR Report no. 576), publications appearing in the interim period have been evaluated. Particular emphasis was placed on the thermodynamic status of the clay minerals, the long term stability of montmorillonite and interactions with other repository components. Smectites and illites are presumably thermodynamically unstable and even the formation of metastable solubility equilibria is questionable. Basic problems are thus encountered when formulating equilibrium models for the clay/water interaction. It can be concluded from investigations of argillaceous sediments that, given a repository temperature of 50 to 60 degrees C, a maximum of 50 % of the montmorillonite will alter to illite over a period of around 10/sup 8/ years. The formation of such illite/smectite interstratifications does not impair the function of the backfill material. Since the alteration of calcium montmorillonite is very restricted in comparison with that of the sodium variant, a calcium bentonite should be foreseen as the backfill material. Magnetite is probably unstable in the presence of montmorillonite. The thermodynamic data and experimental results necessary to allow a reliable assessment of potential interactions between the bentonite and the steel canister corrosion products are lacking. Given the current state of knowledge, the formation of iron-rich microcrystalline layer silicates is to be expected. Montmorillonite in contact with alkaline cement porewaters reacts to form zeolites. This alteration is linked with a volume increase and a loss of plasticity. (author) 127 refs., 31 figs., 4 tabs.

57107 **(PINSTECH/NPD—123) Kinetics of heterogeneous catalysis oxidation of carbon monoxide.** Khawaja, Y.; Sadiq, A. (Pakistan Inst. of Nuclear Science and Technology, Islamabad. Nuclear Physics Div.). Oct 1987. 21p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704404/JAW.

An irreversible kinetic surface-reaction model, based upon the reaction of carbon monoxide nd oxygen on a catalyst surface is investigated by means of Monte Carlo simulation. The adsorbed molecules/atoms on the surface undergo both first and second order kinetic phase transitions. The first order transition is found to occur at x/sub/co=x/sub/2=0.5255 with an error bar of 0.0003, where x/sub/co is the concentration of carbon monoxide in the gas phase. The time evolution of this catalytic reaction is studied both analytically and by computer simulation. Slightly above x/sub/2, the oxygen coverage relaxation time for the oxygen is found to diverge as the inverse of 3.54 times the absolute of the difference of x/sub/2 and x/sub/co. (orig./A.B.). 9 fig.

57108 **(PNL-SA—15361) New chemicals production techniques from designed catalysts.** Young, J.K.; Eberhardt, J.J.; Lyke, S.E. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 22p. (CONF-880850—16). NTIS, PC A03/MF A01. Order Number DE89000396/JAW.

From American Institute of Chemical Engineers summer national meeting; Denver, CO, USA (21 Aug 1988).

As a result of a new approach to R&D being developed by the scientific community, innovative catalytic processes may be discovered that use ideal catalysts (catalysts that operate at or near the thermodynamic limits of a chemical reaction). Such processes, resulting from a historic convergence of new capabilities for materials research, will dramatically influence the economics of processing chemicals. To demonstrate the economic potential of the new approach and how that potential might be realized, we describe a theoretical case study for styrene production. 10 refs., 4 figs., 8 tabs.

57109 **(PNL/SRP—6667) Reduction of sulfate by hydrogen in natural systems: A literature review: Salt Repository Project.** Mahoney, J.J.; Strachan, D.M. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1988. Contract AC06-76RL01830. 21p. NTIS, PC A03/MF A01. Order Number DE89000261/JAW.

The results of this literature search indicate that the reduction of sulfate by hydrogen gas can occur in nature, but that temperature appears to be a key factor in the rate of this reaction. At temperatures below 200{degree}C, the key factor in the rate of reaction appears to be extremely slow. At low pH the rate of reaction is faster than at high pH. The solution composition also influences the reaction rate; the most recent research available (Yanisagawa 1983) suggests that the concentration of sulfide in solution influences the rate of this reaction. The reduction reaction appears to proceed through a thiosulfate intermediate, so the presence and

distribution of other sulfur species will influence the reaction rate. If the reaction mechanism proposed by Yanisagawa is correct, then higher concentrations of sulfide will result in faster rates of sulfate reduction. In conclusion, the reduction of sulfate by hydrogen to form significant amounts of sulfide is a function of temperature, sulfate and sulfide concentrations, pH, and solution composition. The rate of this reaction appears to be very slow under the conditions anticipated in this repository, but given the length of time required to maintain the integrity of the containers (300 to 1000 years) and the unusual solution compositions present, a better understanding of the reaction mechanism is needed. 16 refs., 1 tab.

57110 **Adiabaticity and nonadiabaticity in bimolecular outer-sphere charge transfer reactions.** Beratan, D.N.; Onuchic, J.N. (Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California 91109). *Journal of Chemical Physics;* **89**: No. 10, 6195-6203(15 Nov 1988).

A model for outer-sphere bimolecular electron transfer reactions is presented which is based on a rate expression correct in the adiabatic, nonadiabatic, and intermediate dynamical regimes for an overdamped solvent coordinate. A complete discussion of the timescale separations needed to define a bimolecular rate for these electron transfer reactions is given. Bimolecular reaction rates are predicted to display distinct solvent and electronic coupling dependencies, defined by a few experimentally variable parameters, which we now identify. Also, a significant intermediate dynamical regime is predicted to exist in which the rate is sensitive to both electronic coupling and nuclear relaxation. Evidence that both extreme dynamical regimes have been accessed experimentally is recalled, and strategies are presented for fully mapping out the dependence of rate on the electronic coupling and relaxation times.

57111 **Effect of a conical intersection on cross sections for collision-induced dissociation.** Blais, N.C.; Truhlar, D.G.; Mead, C.A. (Chemistry Division Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Chemical Physics;* **89**: No. 10, 6204-6208(15 Nov 1988).

The cross section for $H+H_2(v, j)\rightarrow 3H$, where v and j denote selected vibrational and rotational quantum numbers, is calculated by the quasiclassical trajectory method, using trajectory surface hopping to include the effect of the first excited electronic state which has a conical intersection with the ground state. The excited electronic state allows for collision-induced dissociation by the process $H+H_3(X\ ^1\Sigma^+/sub\ g/)\rightarrow H_3(1\ ^2A')\rightarrow H_3(2\ ^2liA') \rightarrow H+H_2(b\ ^3\Sigma^+/sub\ u/)\rightarrow 3H$, where the various transitions all occur in the course of a single collision. This new surface hopping mechanism increases the cross sections and rate constants for production of unbound states by 2%—44% for the conditions examined.

57112 **Dynamics of endoergic substitution reactions. I. Br+chlorinated aromatic compounds.** Robinson, G.N.; Continetti, R.E.; Lee, Y.T. (Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory and Department of Chemistry, University of California, Berkeley, California 94720). *Journal of Chemical Physics;* **89**: No. 10, 6226-6237(15 Nov 1988).

The endoergic substitution reactions $Br+R—Cl\rightarrow Cl+R—Br$ (R = o-, m-, and p-$CH_3C_6H_4$, C_6H_5, C_6F_5; $\Delta H°\cong 15$ kcal/mol) have been studied using the crossed molecular beams method in the collision energy (E/sub c/) range 20—35 kcal/mol. The $CH_3C_6H_4Br$ and C_6F_5Br products were found to be mostly forward scattered with respect to the incident Br beam indicating that the lifetimes of the Br—R—Cl collision complexes are short compared to their rotational periods. The product translational energy distributions and excitation functions for these reactions are well reproduced by statistical calculations that assume that only a few vibrational modes in the collision complexes participate in intramolecular energy redistribution prior to Cl elimination. Ring substituents are found to affect both the extent of energy redistribution in the complexes and the probability of Br addition. For example, no substitution product was observed with m-$CH_3C_6H_4Cl$ or C_6H_5Cl. The relative magnitudes of the cross sections are explained in terms of possible features of the potential energy surfaces along their reaction coordinates.

57113 **Dynamics of endoergic substitution reactions. II. $Br+\{C_2H_2Cl_2\}\rightarrow Cl+\{C_2H_2ClBr\}$.** Robinson, G.N.; Continetti, R.E.; Lee, Y.T. (Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory and Department of Chemistry, University of California, Berkeley, California 94720). *Journal of Chemical Physics;* **89**: No. 10, 6238-6246(15 Nov 1988).

We have extended the crossed beams studies described in the preceding paper to the reactions of Br atoms with 1,1- and trans-dichloroethylene. The shapes of the product translational energy distributions and excitation functions for both reactions support our previous conclusion that Cl elimination from Br—R—Cl collision complexes can compete with Br elimination only in the limit that few vibrational modes of the complex are active in energy redistribution. The substitution cross section for the $Br+CH_2CCl_2$ reaction is considerably lower than that for the Br+trans-CHClCHCl reaction in the collision energy range 15—25 kcal/mol, suggesting that steric effects play a dominant role in determining the relative magnitudes of the cross sections.

57114 **Dynamics of the condensation reactions of C^+ with C_2H_4 and C_2H_2.** Sonnenfroh, D.M.; Farrar, J.M. (Department of Chemistry, University of Rochester, Rochester, New York 14627). *Journal of Chemical Physics;* **89**: No. 10, 6255-6266(15 Nov 1988).

The condensation reactions of C^+ with C_2H_4 and C_2H_2 yielding new carbon—carbon bonds have been studied with crossed beam methods in the collision energy range from 0.5 to 1.5 eV. The data show that the reactions take place through short-lived collision complexes living a fraction of a rotational period. These results are shown to be consistent with schematic potential energy surfaces constructed from heats of formation and molecular structure calculations indicating that the large exothermicities of the reactions in comparison with the stabilities of intermediate $C_3H^+_4$ and $C_3H^+_2$ complexes should yield lifetimes in the 10^{-13} s regime. The data for $C_3H^+_2$ formation from the reaction of C^+ with C_2H_4 suggest two distinct production channels. These results are consistent with photoion-photoelectron coincidence breakdown curves for $C_3H^+_2$ formation in the dissociative ionization of C_3H_4 isomers. The least exothermic reaction, C_3H^+ from reaction with ethylene, shows behavior in closest agreement with statistical predictions, specifically product kinetic energy distributions that scale with the total energy accessible to the products. This result is also in qualitative agreement with the nature of the potential energy surface mediating the reaction and lifetimes expected from the reaction energetics.

57115 **Diabatic reaction path Hamiltonian.** Miller, W.H.; Ruf, B.A.; Chang, Y. (Department of Chemistry, University of California and Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Journal of Chemical Physics;* **89**: No. 10, 6298-6304(15 Nov 1988).

A reaction path Hamiltonian is constructed that is based on a straight-line, least motion path that interpolates linearly between equilibrium reactant and product geometries of the molecular system. Conservation of linear and angular momentum are correctly accounted for. The resulting Hamiltonian has a Cartesian-type kinetic energy, the Coriolis coupling terms originally present in the kinetic energy having been transformed to potential energy coupling (hence the term "diabatic" reaction path Hamiltonian). Curvature coupling terms that appear in the original reaction path Hamiltonian, which is based on the minimum energy reaction path, are absent here because the present reaction path is straight. This new, diabatic reaction path Hamiltonian should be especially useful for describing H-atom transfer reactions in polyatomic systems, a case for which the minimum energy reaction path provides a poor description.

57116 **Chemisorption structure of c(2 x 2)S/Fe(001) determined by angle-resolved photoemission extended fine structure.** Zhang, X.S.; Terminello, L.J.; Kim, S.; Huang, Z.Q.; Schach von Wittenau, A.E.; Shirley, D.A. (Department of Chemistry, University of California and Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Journal of Chemical Physics;* **89**: No. 10, 6538-6546(15 Nov 1988).

An accurate chemisorption geometry was determined for the c(2x2)S/Fe(001) system using the angle-resolved photoemission extended fine structure (ARPEFS) method, with S(1s) photoelectron peak intensities observed along [001] and [011]. Multiple-scattering spherical-wave analysis confirmed the LEED-derived fourfold hollow site geometry, and yielded perpendicular distances for S of 1.09(2) A above the first layer and 2.50(2) A above the second layer atom directly below S. The S—Fe nearest-neighbor bond length is 2.30(1) A and the M—S—M bond angle is 123(1)°. The Fe_1 —Fe_2 interlayer distance is contracted to 1.40(2) A and the Fe_2 —Fe_3 distance expanded to 1.46(3) A, relative to the bulk value of 1.43 A. The results are compared with similar systems and partially explained on chemical grounds. The derived structure agrees with the results of a self-consistent field (SCF) Xα spherical wave (SW) calculation.

57117 **Rietveld refinement of the todorokite structure.** Post, J.E.; Bish, D.L. (Smithsonian Institute, Washington, DC (USA)). *American Mineralogist;* **73**: No. 7-8, 861-869(Jul-Aug 1988).

Rietveld refinements, using powder X-ray data, of the structures of todorokite samples from South Africa and Cuba have confirmed the basic [3 x 3] tunnel structure and, for the first time, have provided information about the positions of the tunnel cations and water molecules. Fourier-difference maps and subsequent refinements show a major tunnel site at about (0.36, 0, 0.35) and smaller more diffuse areas of electron density near (0.70, 1/2, 0.38) and (1/2, 1/2, 1/2). Structure-energy calculations suggest that the first two positions are occupied by water molecules and the third by cations such as Na and Ca. The difference maps indicate considerable positional disorder on the tunnel sites, probably caused by various tunnel contents and configurations of lower-valence octahedral cations in different unit cells. The Mn, O octahedra at the edges of the triple chains have larger mean Mn-O distances and probably accommodate the larger cations found in todorokite, e.g., Mg^{2+}, Mn^{2+}, Cu^{2+}, Ni^{2+}, etc.

57118 **Multiphoton spectroscopy of ammonia.** Ashfold, M.N.R.; Bennett, C.L.; Dixon, R.N.; Little, N.; Stickland, R.J.; Western, C.M. (Univ. of Bristol (England)). pp 149-158 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

The use of multiphoton excitation methods has added greatly to their knowledge of the singlet excited electronic states of the ammonia molecule. The more generous vibronic selection rules associated with one color multiphoton transitions enable observation of excited states that are forbidden in one-photon absorption. Two excited states of ND_3 (the B^1E'' and C'^1A_1' respectively) are sufficiently long lived that they may profitably be studied by two-photon sub-Doppler spectroscopy. At this resolution it is possible to fully resolve the Zeeman splitting of individual rovibrational levels of B state ND_3 molecules in a magnetic field and thence to derive a value for the electron orbital magnetic moment in this degenerate state. The use of two color multiphoton excitation methods offers yet more opportunities for probing the spectroscopy and dynamics of excited electronic states and, in this article, they highlight the value of such optical-optical-double resonance techniques in investigations of (a) very heavily predissociated rovibronic levels of A state ammonia and (b) Jahn-Teller induced vibronic levels of B state ammonia.

57119 **Clusters and cluster chemical reactions.** Bernstein, E.R.; Warren, J.A.; Nimlos, M.R. (Colorado State Univ., Fort Collins (USA)). pp 159-172 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

Chemical reactions are studied in isolated supersonic jet generated clusters using 2-color Time of Flight Mass Spectroscopy (TOFMS) to detect the effect of chemical transformation on the cluster spectra. Two reactions are considered in this work: electron transfer and proton transfer. The systems for electron transfer studies are 3- and 4-dimethylaminobenzonitrile clustered are 2-pyridone clustered with H_2O and NH_3.

57120 **Linear spectroscopy using non-linear optics: vacuum ultraviolet laser photoionization spectroscopy of HI.** Hart, D.J.; Hepburn, J.W. (Univ. of Waterloo, Ontario (Canada)). pp 173-183 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

By using frequency mixing techniques, the range of laser spectroscopy can be extended to very short wavelengths, where photon absorption may lead to molecular ionization. In this paper a recent application of coherent VUV to the study of photoionization of HI in a supersonic beam will be discussed. Resonant four-wave sum mixing in Hg vapor was used to generate intense, narrow-band light at wavelengths shorter than 1190 A, which was used to measure the total cross section for photoionization of HI between the two lowest ionization limits of 10.386eV (to form HI^+ (^{2}II/sub 3/2/)) and 11.051eV (to form HI^+ (^{2}II/sub 1/2/)). The spin-orbit autoionization resonances found in this spectral region were recorded at very high resolution, and the spectrum was assigned to several Rydberg series converging on the upper ionization limit. There was a dramatic difference between the photoionization spectrum of 300K HI and jet-cooled HI, an effect attributed to the difference in rotational temperature.

57121 **Vibrational relaxation of highly excited molecules.** Gordon, R.J.; Beck, K.M.; Koshi, M.; Vlahoyannis, Y.P. (Univ. of Illinois, Chicago (USA)). pp 193-200 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

Two sets of experiments were performed to measure the vibration-to-translation (VT) and vibration-to-vibration (VV) relaxation rates of highly excited polyatomic molecules. In both studies the donor molecules were excited by infrared multiphoton absorption. In the first study the rates of VT relaxation of SF_6 and ethyl acetate in an argon bath were measured, using the technique of time-resolved optoacoustics. A fundamental issue addressed in these experiments was whether or not these molecules relax exponentially. In the second study the rate of VV transfer of energy from SF_6 to N_2O was measured in an argon bath.

57122 **Characterization and exploitation of vibrationally excited populations produced by IRMPA.** Barker, J.R.; Yerram, M.L. (Univ. of Michigan, Ann Arbor (USA)). pp 201-214 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

Infrared Multiphoton Absorption (IRMPA) has been used to produce populations of vibrationally excited 1,1,2-trifluoroethane, which were characterized by optoacoustic measurements of absorbed laser power and collision free decomposition yields. The measurements were accurately fitted with a Master Equation that included Quack's theory of IRMPA, three RRKM unimolecular reaction channels, and collisional energy transfer. The adjustable parameters were very highly constrained to fit the data and the re-

sults indicate that the optical coupling matrix elements are dramatically reduced in magnitude near reaction threshold energies where vibrational anharmonicity becomes important. Observed infrared fluorescence from the excited molecules is in excellent agreement with Master Equation predictions and it was used to monitor collisional deactivation of the excited molecules. The energy transfer exhibits a weak vibrational energy dependence and no detectable temperature dependence. Experiments are now underway to ascertain the effect of vibrational energy on bimolecular reactions of TFE, but no such effects have yet been observed.

57123 **Multiple photon absorption and self-focusing of a CO_2 laser pulse in CDF_3.** Beaudoin, Y.; Galarneau, P.; Normandin, A.; Niu, Z.A.; Yergeau, F.; Chin, S.L.; Evans, D.K.; McAlpine, R.D. (Universite Laval, Quebec (Canada)). pp 215-225 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

The fluoroform molecule has very selective photochemistry for the enrichment of the isotopes of hydrogen and has been the object of many studies which had the aim of finding a new process for the production of heavy water. For such an application, design of the reaction cell requires good understanding of how the laser beam propagates through the mixture of CDF_3 and CHF_3. Results from measurements of self-focusing (S.F.) and self-defocusing (S.D.) in CDF_3, using a variety of laser frequencies, could not be explained by the model proposed for SF_6. A model of the way in which molecules interact with the laser light when there is absorption of one or many photons is proposed which is consistent with observations.

57124 **IR Multiphoton absorption with a high pressure CO_2 laser: role of the laser linewidth.** Angelie, C.; Capitini, R.; Girard, P. (CEN Saclay, Gif sur Yvette (France)). pp 226-234 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

The IR multiphoton absorption (MPA) of $^{12}CF_3I$, $^{13}CF_3I$, CF_3Br and SF_6 by means of a 10 Atm CO_2 laser has been investigated in cell, using a double ratiometer method (empty and filled cell). The spatial, spectral, and temporal characteristics of the laser emission have been carefully measured showing linewidth broadening and splitting and spatial distortions in the laser gain minima. The main result of this study is that the peaks observed in the different MPA spectra are clearly correlated to the laser gain curve but not to the fine molecular spectroscopy. A laser bandwidth effect is the most probable explanation. Assuming this explanation, it is possible in turn to extract from the reported spectra the dependence $\sigma(\gamma/\text{sub L/})$ of the MPA cross section versus the laser bandwidth $\gamma/\text{sub L/}$. A semi quantitative interpretation of the $\sigma(\gamma/\text{sub L/})$ curve is attempted but seems only possible if it is assumed that a background of weak resonances, bearing about 1-2% of the total oscillator strength, and with a typical spacing 0.1 - 0.2 cm^{-1}, plays an important role in the low part of the vibrational ladder.

57125 **Synthesis and structure of zeta-(BEDT-TTF)$_2$(I_3)(I_5) and (BEDT-TTF)$_2$(I_3)(TlI_4): comparison of the electrical properties of organic conductors derived from chemical oxidation vs. electrocrystallization.** Beno, M.A.; Geiser, U.; Kostka, K.L.; Wang, H.H.; Webb, K.S.; Firestone, M.A.; Carlson, K.D.; Nunez, L.; Whangbo, M.H.; Williams, J.M. (Argonne National Lab., IL (USA)). *Inorganic Chemistry;* **26**: No. 12, 1912-1919(17 Jun 1987). Contract FG05-86ER45259;W-31-109-ENG-38.

Chemical oxidation of bis(ethylenesithio)tetrathiafulvalene(BEDT-TTF or ET, $C_{10}S_8H_8$) in benzonitrile solution by slow diffusion of iodine vapor produces a mixture of black lustrous crystals. These include the well-known α- and β-$(ET)_2I_3$ phases, δ-$(ET)I_3$ and epsilon-$(ET)_2(I_3)(I_5)$/sub 0.5/, as well as a new phase, zeta-$(ET)_2(I_3)(I_5)$. Data are presented for single-crystal x-ray diffraction studies, and the crystal structure is discussed. Although the materials are metallic to temperatures as low as 1.7K, they do not undergo transitions to the superconducting state. Band electronic structure calculations based on the crystal structure parameters of epsilon-$(ET)_2(I_3)(I_5)$/sub 0.5/ and zeta-$(ET)_2(I_3)(I_5)$ predict semiconducting properties for stoichiometric crystals. A new salt, $(ET)_2(I_3)(TlI_4)$ was prepared by electrochemical oxidation, and crystal data are reported for the salt, which is a semiconductor, in agreement with the band structure calculations. 27 references, 7 figures, 6 tables.

57126 **Process for producing furan from furfural aldehyde.** Diebold, J.P.; Evans, R.J. US Patent Application 6-034,358. 6 Apr 1987. 22p. Contract AC02-83CH10093. NTIS, PC A03/MF A01.

A process of producing furan and derivatives thereof as disclosed. The process includes generating furfural aldehyde vapors and then passing those vapors over a zeolite catalyst at a temperature and for a residence time effective to decarbonylate the furfural aldehydes to form furans and derivatives thereof. The resultant furan vapors and derivatives are then separated. In a preferred form, the furfural aldehyde vapors are generated during the process of converting biomass materials to liquid and gaseous fuels.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 56976, 57003, 57104

4005 Photochemistry

REFER ALSO TO CITATION(S) 57138

57127 **(DOE/ER/13766—2) Reactions of metal ions and their clusters in the gas phase using laser ionization - Fourier transform mass spectrometry: Progress report, August 1, 1987--January 31, 1989.** Freiser, B.S. (Purdue Univ., Lafayette, IN (USA). Dept. of Chemistry). Sep 1988. Contract FG02-87ER13766. 6p. NTIS, PC A02/MF A01. Order Number DE88017281/JAW.

This past year has been another outstanding one for us, with progress made on a number of fronts. The thrust of our work continues to be the study of the chemistry and photochemistry of gas phase transition metal ions, metal-ligand ions, and small metal cluster ions using powerful Fourier transform mass spectrometric methods. This quarter, $LaFe^{2+}$ was synthesized. The bonding and the measurement of kinetic energy released during dissociation is briefly discussed.

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 56280

57128 **(AERE-R—13001) Radiolytic oxidation. Annual report 1987.** Burns, W.G.; Ewart, F.T.; Hobley, J.; Smith, A.J.; Walters, W.S.; Williams, S.J. (UKAEA Harwell Lab. Chemistry Div.). Apr 1988. 27p. (DOE-RW—88.071). H.M. Stationery Office, London, price Pound 5.00.

Progress made under the Radiolytic Oxidation contract to the end of 1987 is reviewed. In the experimental programme further evidence has been obtained for the oxidation of neptunium(IV) under gamma irradiation in granite and bentonite equilibrated waters. No evidence has been found for radiolytic oxidation of neptunium in concrete equilibrated water with a pH value greater than 12. Pertechnetate is reduced to a less soluble oxidation state when a solution in contact with 3:1 BFS/OPC cement is gamma-irradiated under argon. Modelling work has found good agreement for the simulation of aqueous chemistry between the thermodynamic code (PHREEQE) and a kinetic code using a FACSIMILE program. Preliminary simulations of radiolysis under repository conditions have been made using FACSIMILE.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 56363, 56364, 56672, 56674, 58048

57129 **(CEA-tr—2195) Uranium oxidation by nitrous acid and by nitric acid. Plutonium oxidation by nitrous acid.** Koltunov, V.S. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Feb 1986. 49p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755002/JAW.

Chemical reaction kinetics and mechanisms are reviewed and discussed in this paper.

57130 (UJV—8034-CH,B, pp 10-12) **Introduction of injectable /sup 201/Tl-thallium chloride production by UJV.** Kopecky, P.; Cifka, I.; Zdrazil, K.; Kopecka, B.; Svihla, P. Sep 1987. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704162/JAW. (CONF-8612161—).

From 4. international symposium of CMEA countries on radiopharmaceuticals and RIA kits; Obninsk, USSR (16 Dec 1986).

The /sup 201/Tl radionuclide is obtained by irradiating thallium metal with protons, i.e., by the reaction /sup 203/Tl(p,3n)/sup 201/Pb -> /sup 201/Tl. The chemical processing of the irradiated mixture proceeds in two stages. In the first stage starting 1 h after the irradiation, carrier-free radioactive lead is separated from the macro amount of the thallium mixture. In the second stage following after 24 hours, the thallium fraction is separated from the residual activity of lead isotopes. The production line for the injectable /sup 201/Tl chloride solution is installed in four semihot chambers. The technology of production is described in detail and the basic specifications are listed of the preparation manufactured. (J.B.). 4 tabs.

57131 (UJV—8034-CH,B, pp 24-28) **Radioiodine-labelled preparations.** Hradilek, P.; Kronrad, L.; Peresleniova, Eh.; Kopicka, K.; Becicova, M. Sep 1987. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704162/JAW. (CONF-8612161—).

From 4. international symposium of CMEA countries on radiopharmaceuticals and RIA kits; Obninsk, USSR (16 Dec 1986).

UJV Rez manufactures /sup 123/I-labelled sodium iodide, o-iodohippurate, fatty acids, antipyrine, bromosulfophthalein and amphetamine to meet the needs of nuclear medicine. The application areas for the preparations are listed, the principle of their production is explained and their characteristics are tabulated. (E.S.). 5 tabs., 2 figs., 8 refs.

57132 (UJV—8034-CH,B, pp 29-30) **Introduction of injectable /sup 67/Ga-gallium citrate production by UJV Rez.** Kopecky, P.; Cifka, I.; Nemec, S.; Strait, Z. Sep 1987. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704162/JAW. (CONF-8612161—).

From 4. international symposium of CMEA countries on radiopharmaceuticals and RIA kits; Obninsk, USSR (16 Dec 1986).

The irradiation parameters are presented for the preparation of the /sup 67/Ga radionuclide using the U-120 M cyclotron, and the preparation is described of the irradiation target. The /sup 67/Ga-gallium citrate injectable solutions are prepared in three semihot chambers. The technology is briefly outlined. The basic specifications of the preparation are summed up (radionuclide purity, /sup 66/Ga and /sup 65/Zn content, radiochemical purity, chemical purity, pH, specific activity and chemical composition). The schedule of preparing the preparation at UJV Rez is tabulated. (E.S.). 1 tab.

57133 (UJV—8034-CH,B, pp 34-36) **Quality of radiopharmaceuticals produced by Nuclear Research Institute (UJV) Rez.** Sara, V.; Moravec, J.; Kronrad, L. Sep 1987. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704162/JAW. (CONF-8612161—).

From 4. international symposium of CMEA countries on radiopharmaceuticals and RIA kits; Obninsk, USSR (16 Dec 1986).

The quality control system for radiopharmaceuticals is described. The first control takes place during the production and is focused mainly on the radiochemical purity of the preparations. The result of the technical inspection of final products decides on despatch of radiopharmaceuticals to nuclear medicine departments. A third type of control is a complex analysis of randomly selected preparations by the State Institute for Drug Control. It is aimed at the tightness of the vial seals, the looks of the preparations, pH, volume, specific activity, and sterility. In addition, specific parameters are tested depending on the type of radiopharmaceutical. The parameters of the radiopharmaceuticals are compared to those of foreign products. (E.S.). 1 tab.

57134 (UJV—8034-CH,B, pp 2-4) **Organization of quality control of radiopharmaceuticals in Czechoslovakia.** Cifka, J.; Beran, M.; Kopecka, B.; Kopecky, P.; Kronrad, L.; Melichar, F.; Prokop, I.; Sara, V.; Rokos, A.; Komarkova, I. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia); Ceskoslovenska Komise pro Atomovou Energii, Prague). Sep 1987. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704162/JAW. (CONF-8612161—).

From 4. international symposium of CMEA countries on radiopharmaceuticals and RIA kits; Obninsk, USSR (16 Dec 1986).

Quality control of domestic radiopharmaceuticals proceeds in two stages, viz.: 1. Interoperation check of the major parameters is performed by the personnel of production. For iodine-isotope-labelled compounds, radiochemical purity, pH, specific activity, and outer appearance are determined. For /sup 99m/Tc-pertechnetate, specific activity and informally also /sup 99/Mo level are checked. The testing of /sup 113m/In generators is done on an individual basis. The content of /sup 113/Sn, acidity and eluate stability are tested. For /sup 67/Ga-labelled compounds, radionuclide purity, specific activity and the content of iron are checked. 2. The testing of final products is performed as specified by the State Institute for Drug Control. The quality control of imported preparations is focused on their activity and radionuclide purity. Some preparations are checked several times a year. New radiopharmaceuticals introduced in practice can only be registered on the basis of results of toxicological, pharmacokinetic, pharmacodynamic, radiological, and clinical trials. (J.B.).

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 56183, 57099

57135 **(AD-A—194787/8/XAB) Flame extinction in a temporally developing mixing layer.** Givi, P.; Jou, W.H.; Metcalfe, R.W. (Flow Research Co., South Kent, WA (USA)). 1986. 12p. (FLOW-TP—147). NTIS, PC A03/MF A01.

Pub. in Symposium (International) on Combustion/The Combustion Inst. (21st), 1251-1261(1986).

Nonequilibrium effects leading to the local quenching of a diffusion flame were investigated by examining the evolution of large-scale structures in a two-dimensional temporally developing mixing layer. Pseudospectral calculations of a temperature-dependent, nonpremixed, constant-density, reacting shear layer indicate that the primary important parameter to be considered for flame extinction is the local instantaneous scalar dissipation rate, conditioned at the scalar stoichiometric value (Xst). At locations where this value is increased beyond a critical value (Xq), the local temperature decreases and the instantaneous reaction rate drops to zero. This is consistent with the results of perturbation methods employing large activation energy asymptotics for the study of flame extinction in nonpremixed flames.

57136 **(AD-A—195011/2/XAB) Experiments and modeling of multi-component fuel behavior in combustion. Final report, September 1984-November 1987.** Solomon, P.R.; Hamblen, D.G.; Serio, M.A.; Tarantul, K.S.; Markam, J.R. (Advanced Fuel Research, Inc., East Hartford, CT (USA)). Mar 1988. 306p. NTIS, PC A14/MF A01.

A computer model was developed to relate pyrolysis and soot formation to fuel properties. A Fourier Transform-Infrared Spectrometer (FT-IR) was used to characterize the effect of temperature, pressure, reaction time, and hydrogen and oxygen concen-

tration of fuels undergoing pyrolysis. The problem of how to identify and measure the hydrogen available for release during pyrolysis was investigated. A detailed data base of a variety of fuels undergoing pyrolysis was developed. The data-base conditions included: temperature 800-1500 C; pressure 1-15 atm; and reaction time 100ms-1 sec. Experimental-data results show that fuels decompose to form small hydrocarbon species prior to the onset of soot formation. A hydrocarbon model was extended to include Rice-Kossiakoff-Herzfeld mechanism to predict the decomposition of long-chain aliphatics to small molecules. A free-radical soot model was developed to predict the growth of soot precursors from the small molecules.

57137 **(SAND—88-1925C) Gaseous hydrocarbon-air detonations.** Tieszen, S.R.; Stamps, D.W.; Westbrook, C.K.; Pitz, W.J. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 33p. (CONF-8810103—1). NTIS, PC A03/MF A01. Order Number DE89001042/JAW.

From Fall meeting of the Western State Section of The Combustion Institute; Laguna Beach, CA, USA (17 Oct 1988).

Detonation cell width measurements are made on mixtures of air and methane, ethane, dimethyl-ether, nitroethane, ethylene, acetylene, propane, 1,2-epoxypropane, n-hexane, 1-nitrohexane, mixed primary hexylnitrate, n-octane, 2,2,4-trimethylpentane, cyclooctane, 1-octene, cis-cyclooctene, 1-7-octadiene, 1-octyne, n-decane, 1,2-epoxydecane, pentyl-ether, and JP4. There is a slight decrease in detonation cell width that is within the uncertainty of the data for stoichiometric alkanes, alkenes, and alkynes with increasing temperature between 25 and 100{degree}C. Also there appears to be no effect of molecular weight from ethane to decane, on detonation cell width for stoichiometric alkanes. Molecular structure is found to affect detonability for C_8 hydrocarbons, where the saturated ring structure is more sensitive than the straight-chain alkane. Unsaturated alkenes and alkynes are more sensitive to detonation than saturated alkanes. However, the degree of sensitization decreases with increasing molecular weight. Addition of functional groups such as nitro, nitrate, epoxy, and ethers are found to significantly reduce the detonation cell width from the parent n-alkane. Nitrated n-alkanes can be more sensitive than hydrogen-air mixtures. The increase in sensitivity of epoxy groups appears to be related to the oxygen to carbon ratio of the molecule. Good results are obtained between the data and predictions from a ZND model with detailed chemical kinetics. 46 refs., 8 figs., 4 tabs.

57138 **(UCRL—97366) Combustion enhancement of methane/ethane mixtures by photodissociation of inhibitors.** Lavid, M.; Stevens, J.G.; Tavakoli, J.; Westbrook, C.K. (Lawrence Livermore National Lab., CA (USA); M.L. Energia, Inc., Princeton, NJ (USA)). 17 Sep 1987. Contract W-7405-ENG-48. 4p. (CONF-871131—2). NTIS, PC A02/MF A01. Order Number DE88016977/JAW.

From Combined meetings of the Eastern Section of the Combustion Institute 20th fall technical meeting on chemical and physical processes in combustion and National Bureau of Standards annual conference; Gaithersburg, MD, USA (2 Nov 1987).

This paper deals with photodissociation of inhibiting species which otherwise lead to chain-terminating reactions. The advantage is compound, not only that the inhibitors are removed, they are dissociated into reactive radicals which participate in chain- branching reactions resulting in combustion enhancement. It was already confirmed experimentally that photodissociation of HO_2, thought to be an inhibitor in H_2/air combusting system, resulted in extension of the second explosion limit by more than 20%. Numerical study of the same hydrogen system showed that the inclusion of the photodissociation of HO_2 into the kinetic model increased the flame speed by 29%. This paper extends the investigation of the above mentioned concept to photodissociation of HO_2 in hydrocarbon/air systems. Furthermore, it identifies aldehydes as potential inhibiting species in hydrocarbon flames, and as good candidates for undergoing photodissociation resulting in combustion enhancement. 15 refs., 2 figs.

57139 **Optical emission studies of atomic, molecular, and particulate carbon produced from a laser vaporization cluster source.** Rohlfing, E.A. (Combustion Research Facility, Sandia National Laboratories, Livermore, California 94550). *Journal of Chemical Physics;* **89**: No. 10, 6103-6112(15 Nov 1988).

We perform optical emission studies on the species generated by the laser vaporization of graphite into a pulsed helium flow. With short flow channels prior to free-jet expansion the emission at short downstream distances is dominated atomic carbon lines and three band systems of C_2: d ^{3}product/sub g/—a ^{3}product/sub u/ (Swan), C ^{1} product/sub g/—A ^{1}product/sub u/ (Deslandres—d'Azambuja), and D ^{1}summation$^+$/sub u/ —X ^{1}summation$^+$/sub g/ (Mulliken). Partially rotationally resolved spectra of the $\Delta v = -1$ Swan bands are analyzed using a band contour approach to obtain rotational temperatures and rough vibrational distributions for C_2 d ^{3}product/sub g/. The direct emission spectrum from the short-channel source becomes a weaker, structureless continuum when viewed at long downstream distances. Similar long-lived continua are induced by a low-fluence laser at 266, 355, or 532 nm when it crosses the expansion emanating from a source with a long flow channel. We attribute these continua to the incandescence of hot carbon particles, T = 2500—4000 K. The continua are fit to a model in which the Planck blackbody function is modified by the particle emissivity to determine particle temperatures and obtain crude estimates of particle sizes. These data provide the first direct evidence that carbon particles are produced in a laser-vaporization cluster source.

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REFER ALSO TO CITATION(S) 56044, 56045, 56077, 56210, 56216, 56531, 56611, 57017, 57033, 57058, 57225, 57261, 57337, 57404, 57407, 57422, 57713, 57793, 58184, 58196, 58300

57140 **(AD-A—195070/8/XAB) Hydrotropes as novel decontaminants. Contractor report, April 1985-November 1986.** Tadros, M.; Bridger, K.; Berrier, A.; Hearns, R. (Martin Marietta Labs., Baltimore, MD (USA)). Feb 1988. 22p. (MML-TR—87-28C). NTIS, PC A03/MF A01.

Tetrapentyl ammonium bromide (TPAB) was found to accelerate the rates of hydrolyses of diphenyl chlorophosphate and agent GD by two orders of magnitude. The reaction rate for diphenyl chlorophosphate was characterized as follows: (1) it increased as the rate of stirring increased; (2) its activation energy 7.99 kcal/mole (the activation energy in the absence of TPAB = 4.65 kcal/mole), and (3) it did not exhibit a maximum value as a function of the concentration of TPAB, as is typically observed in micellar catalysis. Conductivity measurements indicated that TPAB does not form micelles. Sodium xylene sulfonate (SXS) was found to enhance the rate of hydrolysis of diphenyl chlorophosphate. A synergistic effect was observed for combinations of TPAB and SXS.

57141 **(AD-A—195166/4/XAB) Design and production of peptides mimicking the active site of serine esterases with covalent binding to the organophosphorous poison soman. Annual report, 1 July 1984-30 June 1985.** Seltzman, H.H. (Research Triangle Inst., Research Triangle Park, NC (USA)). 9 Dec 1985. 43p. NTIS, PC A03/MF A01.

The objective of this research program is to design, synthesize, and test peptides and peptide mimics that will scavange soman in vivo and thereby provide protection against this CW agent. The test compounds were designed to mimic the active site of serine esterases (AChE), which are the natural targets of soman, enabling them to react with soman and thus protect endogenous AChE. Cyclodextrins derivatized with peptide functional groups and their equivalents such as imidazole, histamine, ethylene diamine, diethylene triamine, catechol, and ethane dithiol were synthesized for testing. The synthesis of precursors to cyclohexapeptides containing histidine, serine, and aspartic acid, which are amino acids that have been implicated in the active site of numerous esterases, were pur-

sued. Testing of the ability of alpha-, beta, and gamma-cyclodextrins to protect AChE frominactivation by soman was carried out in vitro. From this group of compounds, beta-cyclodextrin was observed to preserve the activity of AChE in a dose response manner achieving a 72.1% preservation of activity when present in 200,000 fold excess versus soman after only ten minutes incubation time (beta-cyclodextrin + soman). Neither alpha, nor gamma-cyclodextrin showed any protective effect at the same doses. The test results suggest that beta cyclodextrin is uniquely suited to scavange soman. Improved scavanging might be achieved with the modified cyclodextrins prepared above for testing.

57142 **(AD-A—195279/5/XAB) Synthesis and study of materials for superconducting electronics. Final report, 1 October 1984-30 September 1987.** Tedrow, P.M.; Meservey, R.; Orlando, T.P. (Massachusetts Inst. of Tech., Cambridge (USA)). 27 Mar 1988. 16p. NTIS, PC A03/MF A01.

Study of high-Tc superconductors in single-crystal and thin-film form has begun. Investigation of semiconductor tunnel barriers has led to improvement of their theoretical description. Transport measurements of layered films of transition-metal nitrides showed evidence of spin-orbit scattering and dimensional crossover effects. A technique for analyzing tunneling conductances to obtain the amount of Zeeman splitting using Fourier transforms has been developed and applied to V_3Ga tunneling data. Spin-orbit scattering rates measured by two independent techniques, spin-polarized tunneling, and magnetoresistance, have been shown to be similar. The strength of Fermi-liquid corrections on the effective magnetic moment of conduction electrons in vanadium and gallium has was using spin-polarized tunneling. The effect of spin-orbit scattering on the density of states of superconducting thin films was measured. The superconducting properties of ultra-thin niobium films were studied.

57143 **(AD-A—195337/1/XAB) Develop a biomedical data base on the medical aspects of chemical defense. Annual report, 25 July 1982-24 July 1983.** Landry, L.A.; Schaefer, D.P. (Associate Consultants, Inc., Washington, DC (USA)). 18 Mar 1984. 215p. NTIS, PC A10/MF A01.

Third-year progress in the development of a computerized data base on selected chemical warfare agents is reported. A prototype data base on agent GD (soman) was completed, followed by expansion to all G-agents and VX, with limited attention to lewisite and mustard compounds. Development of a software thesaurus was begun, with emphasis upon systems refinement, debugging, and documentation.

57144 **(CAPE—3013) Descriptioin of x-ray equipment: [Engineering materials].** (Lawrence Livermore National Lab., CA (USA)). 1986. Contract W-7405-ENG-48. 9 H. Order Number TI88015772/JAW.

These drawings accompany Report No. LLNL--8005429.

The radiographic trailer shown in Drawing AAA84-115298 (Sketch No.1) contains the x-ray equipment permitting its transportation to the place where the radiographic analysis is to be performed. There the x-ray head is deposited on the ground by a winch and ramp and the trailer is moved away. While the trailer is in motion the water hoses and electrical cables connecting the x-ray head to the rest of the equipment are automatically unwinding from the respective drums and deposited on the ground. The maximum distance between the trailer and the x-ray head is 300 ft. After positioning the trailer, the control console is placed at the distance of up to 150 ft from it, while the control cable connecting the console to the trailer is unwinding from its cable drum. The main features of the basic assemblies inside the trailer are described in another document (Reference LLNL-8005429). This document provides aperature cards only.

57145 **(DOE/DP/40200—77) Chirped pulse amplification: Present and future.** Maine, P.; Strickland, D.; Pessot, M.; Squier, J.; Bado, P.; Mourou, G.; Harter, D. (Rochester Univ., NY (USA). Lab. for Laser Energetics; Allied-Signal, Inc., Morristown, NJ (USA)). [1988]. Contract FC08-85DP40200. 6p. NTIS, PC A02/MF A01. Order Number DE89001016/JAW.

Short pulses with ultrahigh peak powers have been generated in Nd: glass and Alexandrite using the Chirped Pulse Amplification (CPA) technique. This technique has been successful in producing picosecond terawatt pulses with a table-top laser system. In the near future, CPA will be applied to large laser systems such as NOVA to produce petawatt pulses (1 kJ in a 1 ps pulse) with focused intensities exceeding 10/sup {plus}21/ W/cm^2. These pulses will be associated with electric fields in excess of 100 e/a/sub o/^{2} and blackbody energy densities equivalent to 3 {times} 10^{10} J/cm^3. This petawatt source will have important applications in x-ray laser research and will lead to fundamentally new experiments in atomic, nuclear, solid-state, plasma, and high-energy density physics. A review of present and future designs are discussed. 17 refs., 5 figs.

57146 **(DOE/ER/13330—1) Focused shock drilling exploratory research program: Final report.** Moeny, W.M.; Aimone, C.T.; Benze, J.W.; Touryan, K.J. (Tetra Corp., Albuquerque, NM (USA)). 31 Aug 1988. Contract FG02-85ER13330. 202p. (TR—88-009). NTIS, PC A10/MF A01. Order Number DE88017243/JAW.

The program to investigate the feasibility of the focused shock spark drilling technique was formally initiated in February 1985 and the work was completed in April 1988. In its initial phase, the program was set to accomplish five objectives. These were: to develop a basic understanding of the physics of spark drilling; to determine rock fracture characteristics at energy levels ranging from 2 to 25 kilojoules (kJ); to demonstrate the feasibility of focusing and steering the high energy shock waves in water; to develop electrode and insulator material designs for an erodable drill face; and to develop a conceptual design for a fieldable spark drill bit. The results of the three-year investigation are reported in this document. The background and rationale are first given. Then a discussion on the following is given: the two pulsed power facilities built for the project; the phenomenology responsible for fracturing and breaking rock through the electrohydraulic effect; development of a conceptual design for a downhole spark drill; and finally, a number of near-term applications are identified for the electrohydraulic effect.

57147 **(DOE/ID/12647—2-Vol.2) Final design report for the prototypical fuel rod consolidation system (Engineering Materials).** (Nutech Engineers, Inc., San Jose, CA (USA)). Dec 1987. Contract AC07-86ID12647. 652p. (DOE—22-199-Vol.2). NTIS, PC A99/MF A01. Order Number DE89000675/JAW.

This report documents NUTECH's final design of a dry, spent fuel rod consolidation system. The scope of Phase 2 of the PCDP has resulted in a final design, plus all of the engineering documentation required to demonstrate that the specified design requirements for the system are satisfied by that design. All the details of NUTECH's final design are described in this PCDP Phase 2 final design report. Compliance with the generic functional requirements, the TAN-specific functional requirements, and all applicable codes and standards is documented in this report. Detailed descriptions are provided of all consolidation equipment and support systems, plus the remote operations and maintenance systems. The equipment and operational systems required for decontamination and radioactive waste management, as well as the other facility and operating requirements are discussed in this report. In many cases, the amount of detailed work performed resulted in documentation too extensive for inclusion in the body of this report; thus, eleven appendices to this report are provided. This document, Volume 2, provides Appendixes A, B, C, and D. These Appendixes discuss engineering drawings, life cycle cost estimation, technical specifications, and fabrication specifications, respectively. Reference CAPE-3008, 3009, 3010, 3011, and 3012.

57148 **(DOE/ID/12647—2-Vol.3) Final design report for the prototypical fuel rod consolidation system (Engineering Materials).** (Nutech Engineers, Inc., San Jose, CA (USA)). Dec 1987. Contract AC07-86ID12647. 872p. (DOE—22-199-Vol.3). NTIS, PC A99. Order Number DE89000676/JAW.

This report documents NUTECH's final design of a dry, spent fuel rod consolidation system. The scope of Phase 2 of the PCDP has resulted in a final design, plus all of the engineering documentation required to demonstrate that the specified design requirements for the system are satisfied by that design. All the de-

tails of NUTECH's final design are described in this PCDP Phase 2 final design report. Compliance with the generic functional requirements, the TAN-specific functional requirements, and all applicable codes and standards is documented in this report. Detailed descriptions are provided of all consolidation equipment and support systems, plus the remote operations and maintenance systems. The equipment and operational systems required for decontamination and radioactive waste management, as well as the other facility and operating requirements are discussed in this report. In many cases, the amount of detailed work performed resulted in documentation too extensive for inclusion in this report; thus, eleven Appendices to this report are provided. This document, Volume 3, contains Appendices E and F. These Appendices provide design review reports and design calculations/tradeoffs/canister packing studies, respectively. Reference CAPE-3008, 3009, 3010, 3011, and 3012.

57149 **(DOE/ID/12647—2-Vol.4) Final design report for the prototypical fuel rod consolidation system (Engineering Materials).** (Nutech Engineers, Inc., San Jose, CA (USA)). Dec 1987. Contract AC07-86ID12647. 700p. (DOE—22-199-Vol.4). NTIS, PC A99/MF A01. Order Number DE89000677/JAW.

This report documents NUTECH's final design of a dry, spent fuel rod consolidation system. The scope of Phase 2 of the PCDP has resulted in a final design, plus all of the engineering documentation required to demonstrate that the specified design requirements for the system are satisfied by that design. All the details of NUTECH's final design are described in this PCDP Phase 2 final design report. Compliance with the generic functional requirements, the TAN-specific functional requirements, and all applicable codes and standards is documented in this report. Detailed descriptions are provided of all consolidation equipment and support systems, plus the remote operations and maintenance systems. The equipment and operational systems required for decontamination and radioactive waste management, as well as the other facility and operating requirements are discussed in this report. In many cases, the amount of detailed work performed resulted in documentation too extensive for inclusion in the body of this report; thus, eleven Appendices to this report are provided. This document, Volume 4, contains Appendix G. This Appendix contains component and system design descriptions. Reference CAPE- 3008, 3009, 3010, 3011, and 3012.

57150 **(DOE/ID/12647—2-Vol.5) Final design report for the prototypical fuel rod consolidation system (Engineering Materials).** (Nutech Engineers, Inc., San Jose, CA (USA)). Dec 1987. Contract AC07-86ID12647. 952p. (DOE—22-199-Vol.5). NTIS, PC A99/MF A01. Order Number DE89000678/JAW.

This report documents NUTECH's final design of a dry, spent fuel rod consolidation system. The scope of Phase 2 of the PCDP has resulted in a final design, plus all of the engineering documentation required to demonstrate that the specified design requirements for the system are satisfied by that design. All the details of NUTECH's final design are described in this PCDP Phase 2 final design report. Compliance with the generic functional requirements, the TAN-specific functional requirements, and all applicable codes and standards is documented in this report. Detailed descriptions are provided of all consolidation equipment and support systems, plus the remote operations and maintenance systems. The equipment and operational systems required for decontamination and radioactive waste management, as well as the other facility and operating requirements are discussed in this report. In many cases, the amount of detailed work performed resulted in documentation too extensive for inclusion in the body of this report; thus, eleven appendices to this report are provided. This document, Volume 5, contains Appendices H and I. These Appendices discuss bench testing reports and operation maintenance, respectively. Reference CAPE-3008, 3009, 3010, 3011, and 3012.

57151 **(DOE/ID/12647—2-Vol.6) Final design report for the prototypical fuel rod consolidation system (Engineering Materials).** (Nutech Engineers, Inc., San Jose, CA (USA)). Dec 1987. Contract AC07-86ID12647. 329p. (DOE—22-199-Vol.6). NTIS, PC A15. Order Number DE89000679/JAW.

This report documents NUTECH's final design of a dry, spent fuel rod consolidation system. The scope of Phase 2 of the PCDP has resulted in a final design, plus all of the engineering documentation required to demonstrate that the specified design requirements for the system are satisfied by that design. All the details of NUTECH's final design are described in this PCDP Phase 2 final design report. Compliance with the generic functional requirements, the TAN-specific functional requirements, and all applicable codes and standards is documented in this report. Detailed descriptions are provided of all consolidation equipment and support systems, plus the remote operations and maintenance systems. The equipment and operational systems required for decontamination and radioactive waste management, as well as the other facility and operating requirements are discussed in this report. This document, Volume 6, provides Appendix J and K. This Appendix provide seismic analysis calculations and quality assurance documentation, respectively. Reference CAPE-3008, 3009, 3010, 3011, and 3012.

57152 **(DP—1755) The Techmation Protuner: A timesaving loop tuning device for improved process control.** Semones, G.B.; Peterson, S.F. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Jun 1988. Contract AC09-76SR00001. 43p. NTIS, PC A03/MF A01. Order Number DE89000633/JAW.

This document describes the Techmation Protuner Model 1100. The Protuner is a compact device for analyzing a process or process control system. This device can tune process controllers, determine process parameters (dead-times, steady state gains, dynamic gains, time constants), and produce Bode and Nichols diagrams. It is fast, portable, user friendly, and compatible with either electronic or pneumatic instrumentation. The Protuner was bought by the Analytical Development Division (ADD) of the Savannah River Laboratory in 1986. This report is the result of over a year of testing and evaluation on processes throughout the Savannah River Plant. This report includes: A description of the Protuner hardware; A description of a typical operating session; Examples typical of the successes achieved by using the Protuner; A specification sheet; A discussion of the tuning algorithms one can use with the Protuner; and A discussion of criteria for choosing the proper controller modes. The Protuner has been used to bring under control processes that had been thought controllable only with advanced strategies, as well as to significantly improve the operation of loops that had been thought to be well-tuned. Information on borrowing ADD's Protuner, arranging demonstrations, and purchasing information is provided. 4 refs., 18 figs.

57153 **(DPST—87-427) Transuranic Waste Test Facility Development Program.** Looper, M.G. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 5 May 1987. Contract AC09-76SR00001. 9p. NTIS, PC A02/MF A01. Order Number DE88017179/JAW.

This letter discusses the development and test program planned for the Transuranic Waste Test Facility (TWTF). The planned effort is based on previous work in the AD&D Pilot Facility and testing of TWTF equipment before installation. Input from Waste Management and AED Fairview is included. The program will focus on the following areas: Retrieval; Material Handling; Size Reduction; Operation and Maintenance. The program will take 1-1/2 to 2 years to complete and began in December 1986. Technical Data Summaries (TDS) and basic data reports will be issued periodically to document results and provide basic data for the Transuranic Waste Facility (TWF). 2 refs., 2 figs.

57154 **(EGG-M—88263) VaporSense contamination-resistant high temperature uv hygrometer.** Gersh, M.E.; Matthew, M.W.; Bangert, M.D.; Shuck, P. (EG and G Idaho, Inc., Idaho Falls (USA); Spectral Sciences, Inc., Burlington, MA (USA); Pacer Systems, Inc., Billerica, MA (USA)). 1988. Contract AC07-76ID01570. 16p. (CONF-8806230—1). NTIS, PC A03/MF A01. Order Number DE88016954/JAW.

From International symposium on optical engineering and industrial sensing; Dearborne, MI, USA (26 Jun 1988).

The use of reliable and accurate hygrometers to monitor and control the operation of drying hoods would result in significant energy savings and improvement in product quality. We have developed such a hygrometer, VaporSense, which operates at high temperature and humidity in environments containing high concen-

trations of particulates and corrosive vapors. VaporSense uses the differential adsorption of light by water vapor at two ultraviolet wavelengths to determine absolute humidity. A uv fiber-optic probe is inserted into the contaminating environment. Optical surfaces are kept clean by a curtain of dry air. VaporSense prototypes have been installed in a variety of industrial drying sites. Stable, long term, contamination free operation was demonstrated. 11 refs., 19 figs.

57155 **(EPRI-EL—5990-SR) Proceedings: Telephone lines entering power substations.** Addis, G.; Mankoff, L. (eds.). (Electric Power Research Inst., Palo Alto, CA (USA)). Aug 1988. 225p. (CONF-8804197—). Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016993/JAW.

From EPRI workshop on telephone lines entering power substations; Atlanta, GA, USA (13 Apr 1988).

The EPRI workshop on "Telephone Circuits Entering Substations" was designed for technology interchange. It also served to evaluate the need for possible joint research by the telephone companies and the electric utilities related to requirements and methods for protection of telephone circuits entering power substations. Attendance at the meeting totalled 57, with a ratio of electric utility to telephone personnel about two to one. Papers were presented on typical applications and practices, modeling and measurement of ground potential rise, a review of the IEEE tutorial on substation grounding design practices, and new, available protective equipments. The ensuing discussions involved disagreements, in some cases, between measured ground potential differences and values derived by modeling. The application of probabilistic and risk analysis techniques, and new technology including semiconducting and non-linear devices for isolating or reducing overvoltages on telephone circuits resulting from ground faults, switching surges or lightning strikes were also included.

57156 (INIS-BR—1229, pp 133) **Superisolated liquid helium dewars and valves for rigid transfer tubes.** Schreiner, W.H.; Schaf, J. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57157 **(LA-UR—88-3148) The effectiveness of metal coated diffraction gratings at grazing and near normal incidence as harmonic scrubbers.** Wantuck, P.J.; Appert, Q.D.; Tong, K.; Pistoresi, D.J. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 25p. (CONF-880904—1). NTIS, PC A03/MF A01. Order Number DE89000359/JAW.

From 4. topical meeting on short wavelength coherent radiation: generation and applications; Cape Cod, MA, USA (26 Sep 1988).

High power free electron lasers (FEL) can produce significant amounts of harmonic radiation. These harmonic components represent a substantial damage threat to the optical elements comprising the laser resonator. In this paper we discuss the merits of using blind gratings in both the paraboloid and grazing incidence hyperboloid mirrors of a 1.06 micron FEL under construction by the Boeing Aerospace Company. Grating designs developed for use at grazing incidence are not very efficient for dispersing harmonics. However, blind gratings positioned in the paraboloid exhibit better filtering capability. 6 refs., 8 figs., 3 tabs.

57158 **(LA-UR—88-3251) Transverse effects of a waveguide coupling slot.** Cooper, R.K.; Chan, K.C.D.; Wang, T.F.; Thode, L.E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 3p. (CONF-881049—12). NTIS, PC A02/MF A01. Order Number DE89000340/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

High-power operation of rf cavities may require that the waveguide supplying energy to the system be coupled to the cavity with a large coupling slot. It is a concern that this coupling slot may be so large that appreciable asymmetry will exist in the fields of the fundamental mode and transverse effects will be introduced on the beam. Computation of these effects is complicated by the facts that the fundamental mode frequency must propagate in the waveguide and resonant cavity codes cannot handle energy transfer across the boundaries of the problem. We have successfully computed these effects using 3-D computer codes in MAFIA, both in the frequency and time domains. This paper will report the computed results showing good agreement with experimental measurements and indicating that the transverse effects can be compensated. The results include mode distortions and transverse forces. The methods of calculation will also be described. 5 refs., 2 figs.

57159 **(LBL—24992) A comparison of the conductor requirements for energy storage devices made with ideal coil geometries.** Hassenzahl, W. (Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC03-76SF00098. 17p. (CONF-880812—9). NTIS, PC A02/MF A01. Order Number DE89000552/JAW.

From Applied superconductivity conference; San Francisco, CA, USA (21 Aug 1988).

Superconducting Magnetic Energy Storage (SMES) plants have been proposed in both solenoidal and toroidal geometries. The former is efficient in terms of the quantity of superconductor required per unit of stored energy. For applications where a fringe field could be a problem, the toroidal geometry, which requires at least a factor of two more material, has been proposed. In addition to the solenoid and toroid, other geometries are possible, such as linear multipoles and spherical coils. These geometries have been considered for use in applications other than energy storage. In this report, the effectiveness (quantity of superconductor/stored energy) is calculated for various coil geometries. 7 refs., 4 tabs.

57160 **(LBL—25812) The high T/sub c/ superconducting bolometer.** Richards, P.L.; Verghese, S.; Geballe, T.H.; Spielman, S.R. (Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC03-76SF00098. 5p. (CONF-880812—15). NTIS, PC A02/MF A01. Order Number DE89001255/JAW.

From Applied superconductivity conference; San Francisco, CA, USA (21 Aug 1988).

A description is given of the optimization of a bolometric infrared detector which uses the resistive transition of a high T/sub c/ film as the thermometer. The performance of a LN cooled far infrared bolometer operated with a cooled low-pass filter is computed for the ideal case of a noise-free readout. The theory is then extended to include various contributions to the readout noise. Measurements are presented of the low frequency noise near T/sub c/ in current biased films of $ErBa_2Cu_3O_7$, which show that useful performance can be achieved. Comparisons are made with other infrared detection technologies which show that practical high T/sub c/ bolometers will be especially useful for wavelengths longer than the {approximately}20 μm cutoff of LN cooled photovoltaic detectors. Potential applications include far infrared laboratory spectroscopy and passively cooled space observations of bright sources such as the earth. 6 refs., 3 figs.

57161 **(LBL—25926) Calculating the J/sub c/, B, T surface for niobium titanium using a reduced-state model.** Green, M.A. (Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC03-76SF00098. 6p. (CONF-880812—10). NTIS, PC A02/MF A01. Order Number DE89000548/JAW.

From Applied superconductivity conference; San Francisco, CA, USA (21 Aug 1988).

This report presents a method for calculating the J/sub c/, B, T surface for commercial niobium titanium superconductor given T/sub c/, B/sub c2/ and J/sub c/ over a range B at a given temperature. The J/sub c/ calculated as a function of B and T agrees with measured values of J/sub c/ quite well over a range of T from 1.5K to 7 K and a range of B from 0.1 T to 10 T. The values of J/sub c/ given by this theory are good enough to be used to calculate the performance of superconducting magnets at temperatures other than 4.2 K, and the theory can be used to predict the magnetization effects of superconductors over a wide range of temperatures and inductions. 16 refs., 6 figs.

57162 (LLNL—8005429) Description of x-ray equipment. Wagner, J. (Lawrence Livermore National Lab., CA (USA)). 9 Dec 1987. Contract W-7405-ENG-48. 5p. NTIS, PC A02/MF A01. Order Number DE88005429/JAW.

The radiographic trailer described in this report contains the x-ray equipment permitting its transportation to the place where radiographic analysis is to be performed. There the x-ray head is deposited on the ground by a winch and ramp and the trailer is moved away. While the trailer is in motion the water hoses and electrical cables connecting the x-ray head to the rest of the equipment are automatically unwinding from the respective drums and deposited on the ground. The maximum distance between the trailer and the x-ray head is 300 ft. After positioning the trailer, the control console is placed at the distance of up to 150 ft from it, while the control cable connecting the console to the trailer is unwinding from its cable drum. The main features of the basic assemblies inside the trailer are described in this document. Reference CAPE-3013

57163 (NEI-FI—43) Periodical inspectious of electrical installations. Kilpi, L.; Kajan, T. (Saehkoeurakoitsijaliitto, Helsinki (Finland)). (Kauppa-ja Teollisuusministerio, Helsinki (Finland). Energiaosasto). Nov 1987. 31p. (In Finnish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754870/JAW.

This research tells about faults in electrical installations in about a hundred dwellings (houses and apartments). A considerable number of faults endangering electrical safety was found even though it must be kept in mind that in the test dwellings there were more than the average amount of faults. Installations that are against electrical safety rules were found in five dwellings out of six. Faults that endager life or property were found in every sixth dwelling. The faults can be classified into three groups of almost equal size: Broken socket outlets, switches, luminaires etc. (i.e. faults discernible to laymen) 30% Installations against rules, normally self-made 50% Other faults (discernible only to professionals) 30%. The main cause of the faults is not the aging of the installations but carelessness and self-made installations. A laymen could have detected over a half of the faults and these could be eleminated by means of efficient information on factors related to normal electrical safety. Periodical inspections of electrical installations, even at intervals of 15 years, would demand considerable resources whereas an inspection in connection with the change or renovation of a house or an apartment would be sufficient and mos of the faults could be found. Yet, at least a fifth of the installations against safety rules would stay unchanged and these can propable be eliminated only by periodical inspections.

57164 (ORNL—6497) Modeling cyclic melting and refreezing in a hollow metal canister. Wilson, D.G.; Flanery, R.E. (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 44p. NTIS, PC A03/MF A01. Order Number DE89001325/JAW.

This report documents the mathematical model and computational algorithms used in a pair of computer programs that do energy redistribution calculations as part of a comprehensive simulation for thermal and structural analyses of one component of a thermal energy storage system for the manned space station. The complete problem includes cyclic melting and refreezing, fluid flow, and void formation and movement, as well as conductive and convective heat transfer in a three dimensional setting. The problem is posed in a hollow, metal canister filled with a high temperature phase change materials. The heat transfer equations discussed here consist of a pair of partial differential equations for energy transfer (one linear the other mildly nonlinear), coupled with a constitutive relation for energy and temperature. This constitutes a weak, enthalpy formulation of the phase change problem. The partial differential equations are approximated by a system of coupled Crank Nicholson-type finite difference equations. These nonlinear, implicit equations are solved for enthalpy (energy content) and temperature fields simultaneously. A successive overrelaxation iteration scheme with red/black ordering is used to solve the nonlinear difference equations. The algorithms have been vectorized for rapid execution on the Cray X-MP supercomputer and techniques used to do this are discussed. 4 refs., 1 fig.

57165 (PB—88-241849/XAB) Break junctions. 1. Interim report, 1 October 1986-31 September 1987. Moreland, J.; Goodrich, L.F.; Ekin, J.W.; Capobianco, T.E.; Clark, A.F. (National Bureau of Standards, Boulder, CO (USA). Electromagnetic Technology Div.). May 1988. 74p. (NBSIR—88/3090). NTIS, PC A04/MF A01.

Measurements of the tunneling current-voltage characteristics of break junctions in conventional superconductors can be used to determine their superconducting energy gap as a function of energy. These results agree with those previously obtained using traditional oxide tunneling barriers. Break junctions in some exotic superconductors, on the other hand, have anomalous current-voltage characteristics compared to BCS predictions. Energy gaps and the Josephson effect measured for the new high T(c) materials YBaCuO (T(c)=93 K) and LaSrCuO (T(c)=36 K) indicate that the samples are inhomogeneous with varying gap functions depending on the location of the tunneling contact within the break junction fracture. Break junction data for these materials are within the strong-coupling limits of BCS theory.

57166 (PB—88-867544/XAB) Superconductive materials and devices. January 1970-July 1988 (Citations from the US Patent data base). Report for January 1970-July 1988. (National Technical Information Service, Springfield, VA (USA)). Aug 1988. 124p. NTIS PC N01/MF N01.

Supersedes PB—87-862371.

This bibliography contains citations of selected patents concerning the design and methods employed in the manufacture of superconductive materials and devices. Methods of fabricating composite materials that are stable under high field strength and high current conditions are discussed. Production of materials used in superconductive winding and switching mechanisms is considered. Superconducting wires used in cryogenic systems, and methods of cooling superconductor devices are included. (This updated bibliography contains 302 citations, 22 of which are new entries to the previous edition.)

57167 (PB—88-867585/XAB) Protective clothing: Arctic and tropical environments. January 1970-July 1988 (Citations from the NTIS data base). Report for January 1970-July 1988. (National Technical Information Service, Springfield, VA (USA)). Aug 1988. 161p. NTIS PC N01/MF N01.

Supersedes PB—87-864500.

This bibliography contains citations concerning clothing for environmental protection in extreme climates. Topics include especially developed fabrics and textiles, insulating methods, physiological and psychological responses by users, mobility and dexterity of wearers, care of specialized clothing, and human factors involved. (This updated bibliography contains 266 citations, 12 of which are new entries to the previous edition.)

57168 (PB—88-867775/XAB) Lightning, surge, and transient protection. December 1982-August 1988 (Citations from the NTIS data base). Report for December 1982-August 1988. (National Technical Information Service, Springfield, VA (USA)). Aug 1988. 152p. NTIS PC N01/MF N01.

Supersedes PB—87-865846.

This bibliography contains citations concerning techniques and devices for the protection of electronic and electrical equipment from lightning and electrical surges, and data and protective devices for lightning strikes on structures, ships, and aircraft. The citations include research on suppressors, limiters, lightning arresters, electromagnetic pulse protection devices, and overvoltage protection networks. Excluded are references to electromagnetic shielding, which are found in a separate published search. (This updated bibliography contains 240 citations, 19 of which are new entries to the previous edition.)

57169 (RF/PRC/T—4/87) Drilling fluid and cementing engineering. The first semi-annual status report 1987. Saasen, A.; Sterri, N.; Jakobsen, J. (Rogalandsforskning, Stavanger (Norway)). Jun 1987. 14p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754875/JAW.

The report concerns a drilling fluid and cementing engineering project. A testing loop is used for the investigation of the displacement performance in pipes and annuluses. The displacement in the system of oil/water for various velocities in pipes and concentric/eccentric annuluses in the vertical and non-vertical positions, are investigated. 6 drawings.

57170 **(SAND—86-7124) Analytical and experimental study of self-resonating water jets: Nozzle-jet and wall-jet interactions.** Chahine, G.L.; Genoux, P.F.; Liu, Han Lieh; Johnson, V.E. Jr. (Tracor Hydronautics, Inc., Laurel, MD (USA)). Oct 1987. Contract AC04-76DP00789. 197p. (TR—83025-1). NTIS, PC A09/MF A01. Order Number DE88015829/JAW.

The studies described in this report are part of an ongoing effort to understand and develop cavitating jets which will enhance the performance of bits used to drill for geothermal or fossil energy. During the first phase we found that the existing CAVIJET{reg←sign} cavitating fluid jet nozzle designs were capable of operating under certain limited downhole conditions, and improved rates of penetration (ROP) were observed with two-cone roller bits during both laboratory and field trials. 26 refs., 75 figs.

57171 **(SAND—87-2823C) A structured lighting vision system for dynamic obstacle avoidance with a mobile robot.** Essenmacher, T.J.; Grafe, V.G.; Davidson, G.S.; Moya, M.M. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 16p. (CONF-881116—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88008673/JAW.

From Advances in intelligent robotics systems; Cambridge, MA, USA (6 Nov 1988).

Sandia National Laboratories is using a mobile robot as the focus of a research effort in artificial intelligence and robotics. One of the sensors on board this robot is a structured lighting vision system for dynamic obstacle avoidance and position updating. A 10 MIPS transputer is used in the structured lighting system to collect and process the image data. Descriptions of the system, sensor hardware, and software algorithms are presented. System limitations are also discussed. 12 refs., 6 figs.

57172 **(SAND—88-0301C) Robotics research at Sandia National Laboratories.** Eicker, P.J. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 16p. (CONF-881118—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88009259/JAW.

From International symposium and exposition on robots; Sydney, Australia (6 Nov 1988).

Robotics research at Sandia National Laboratories is assisting in the automation of operations with in the United States Department of Energy complex. The operations addressed have the characteristics of a batch environment. The research is thus aimed at giving robots the sensing and intelligence which can improve their cost effectiveness in an environment less structured than that encountered in mass production. 11 refs., 9 figs.

57173 **(SAND—88-1486C) Shock response spectrum anomalies which occur due to imperfections in the data.** Bell, R.G.; Davie, N.T. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 20p. (CONF-881076—7). NTIS, PC A03/MF A01. Order Number DE88015846/JAW.

From 59. shock and vibration symposium; Albuquerque, NM, USA (18 Oct 1988).

Shock response spectra are widely used in analysis, design and qualification of components and systems that are subjected to shock environments. The integrity of the data being used to generate the shock response spectrum is very important. Any inaccuracy such as a spurious spike or a zero shift in the data can have a significant impact on the spectrum. Manipulations of the data, decimation of data, or digital filtering, can also have a definite impact on the shock response spectrum. The degree of influence of the error is not always apparent. The effects of these errors on the generation of shock response spectra is shown for an absolute acceleration spectrum. The awareness of these possible errors is shown to require an understanding of the shock spectrum algorithm and knowledge of the effects of signal processing. 11 refs., 24 figs.

57174 **(SAND—88-2264C) Radar data acquisition using MicroVAX and VAXELN custom driver: Session notes.** Anderson, D.F. (Sandia Labs., Tonopah, NV (USA)). 1988. Contract AC04-76DP00789. 18p. (CONF-8810153—1). NTIS, PC A03/MF A01. Order Number DE88015677/JAW.

From Fall DECUS symposium; Anaheim, CA, USA (18 Oct 1988).

This paper gives an overview of radar data acquisition tracking systems. MicroVax interfacing with control panels, graphics displays and the radar system is discussed. Input data format is also discussed. 4 figs. (LSP)

57175 **(SAND—88-2283C) Development testing at Sandia.** Olson, D.M. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 3p. (CONF-881076—4). NTIS, PC A02/MF A01. Order Number DE88014962/JAW.

From 59. shock and vibration symposium; Albuquerque, NM, USA (18 Oct 1988).

Sandia National Laboratories maintains an extensive development test capability including, but not limited to, explosive, climatic, electromagnetic, thermal, mechanical shock, vibration, and static environments. These facilities briefly described.

57176 **(STF—60A87112) Vortex induced vibrations of pipelines in free spans - influence of damping on the maximum vibration amplitude.** Toerum, A.; Bostroem, B. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Nov 1987. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754907/JAW.

The influence of structural damping, including soil damping, on the transversal amplitudes of vibrations during vortex induced vibrations has been investigated. 19 drawings.

57177 **(STF—60A88015) Scour around submerged pipelines in alternating current.** Dahl, T.E.; Yanbao, L. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Jan 1988. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754910/JAW.

This report gives the scour pattern around a submerged pipeline and a sand bed for alternating current. The results were obtained from tests in a flume. 13 drawings, 3 tables.

57178 **(UCID—21520) Mechanical bore damage in round bore composite structure railguns.** Susoeff, A.R.; Hawke, R.S. (Lawrence Livermore National Lab., CA (USA)). 10 Feb 1988. Contract W-7405-ENG-48. 10p. NTIS, PC A03/MF A01. Order Number DE89001285/JAW.

Some experiments conducted with composite structure round bore railguns at LLNL have resulted in the generation of mechanical bore damage. Various concepts to explain this phenomenon in terms of operational techniques or projectile properties have brought forward. This paper discusses the use of various launcher materials, projectile designs, and describes the resultant damage as well as the measurement techniques used. Successful experiments were conducted by use of normal refurbishing techniques in spite of previous damage occurrence. An evolution of projectile design lead to the elimination of bore damage. 5 refs., 10 figs.

57179 **(UCRL—53883) Criticality alarm system for the Lawrence Livermore National Laboratory.** Hill, E.E.; Kolar, O.C. (Lawrence Livermore National Lab., CA (USA)). Sep 1988. Contract W-7405-ENG-48. 20p. NTIS, PC A03/MF A01. Order Number DE89001584/JAW.

The Lawrence Livermore National Laboratory (LLNL) has specified a standard criticality alarm system (CAS) for use in all its nuclear facilities. This report describes the initial CAS as supplied from the vendor and the modifications made to develop a generic system that better suits LLNL needs. Each such system contains gamma detectors, data-acquisition modules (serviced by uninterruptable power supplies), one or more control terminals, and an emergency evacuation alarm module (also with an uninterruptable power supply). Although the primary function of the CAS is to sound an alarm in the event of a criticality accident, the system can

also be used to collect dosimetry data for assessing background radiation levels, to monitor possible secondary criticalities in the event of an accident, and to monitor post-accident conditions remotely. Steps have been taken to assure that these additional functions do not compromise the primary alarm function. The present status of the new standard system, our experience with it, and future plans for other CAS components are also described in this report. 10 refs., 7 figs., 3 tabs.

57180 **(UCRL—98044) A fast radiation-to-coherent light converter.** Wang, C.L.; Flatley, J.E.; Stewart, P.H.; Bar-Chaim, N.; Lau, K.Y.; Ury, I.; Baltrusaitis, R.M.; Davies, T.J.; Davis, B.A.; Iversen, S.G. (Lawrence Livermore National Lab., CA (USA)). 9 Sep 1988. Contract W-7405-ENG-48. 7p. (CONF-8809105—8). NTIS, PC A02/MF A01. Order Number DE89001218/JAW.

From SPIE O-E Lase: international symposium and exhibition on fiber optics, optoelectronics and laser applications; Boston, MA, USA (6 Sep 1988).

We have developed a radiation-to-coherent light converter (RCLC) with a monolithically integrated semiconductor chip that consists of a chromium-doped GaAs photoconductor detector modulates the laser diode, which has been biased above the lasing threshold, thus converting a radiation pulse to an electric pulse and then to a light pulse. The laser pulse is then transmitted to a fast recorder through a high-bandwidth optical fiber. In the absence of a single-step x-ray pumped laser, our converter appears to be the first integrated device that can efficiently convert x-ray flux into coherent light. This device has been tested successfully with the 50-ps electron beams of a 17-MeV linear accelerator and with 50-ns x-ray pulses from a Z-pinch plasma source. 2 refs., 9 figs.

57181 **(UCRL—98481) A performance evaluation of three high-fidelity streak cameras.** Bonlie, J.D.; Lowry, M.E. (Lawrence Livermore National Lab., CA (USA)). 24 Aug 1988. Contract W-7405-ENG-48. 14p. (CONF-880887—19). NTIS, PC A03/MF A01. Order Number DE89001128/JAW.

From 32. international technical symposium on optical and opto-electronic applied sciences and engineering; San Diego, CA, USA (14 Aug 1988).

Several scientific programs at Lawrence Livermore National Laboratory (LLNL) require instrumentation that can capture optical signals with high fidelity. Typically, they require high temporal resolution, high spatial resolution, and high dynamic range. The instrument of choice for most of these multichannel, data-recording applications is the optical streak camera. We have evaluated three optical streak camera systems under similar conditions: the EG&G model L-CA-15 streak camera, designed and built under US Department of Energy (DOE) contract, with a streak tube designed for a time response of a few picoseconds; an in-house (LLNL) design, with an ITT F4157 streak tube that also operates in the extraction mode; and a Thomson-CSF model TSN 506 streak camera, with an ITT F4157 streak tube that also operates in the extraction mode. All three systems were found to be capable of time response better than 40 ps FWHM, a dynamic range of greater than 100, and spatial resolution greater than 5 line pairs per millimeter (1p/mm). The experimental setup and plots of results are presented and discussed. 13 refs., 11 figs.

57182 **(UCRL—98498) High-Speed Microphotographic Laboratory.** Frank, A.M. (Lawrence Livermore National Lab., CA (USA)). 19 Aug 1988. Contract W-7405-ENG-48. 13p. (CONF-8808103—4). NTIS, PC A03/MF A01. Order Number DE88017009/JAW.

From 18. international congress on high-speed photography and photonics; Xian, China (28 Aug 1988).

Lawrence Livermore National Laboratory's (LLNL's) High-Speed Microphotographic Laboratory provides a facility for studying rapidly evolving microstructures. In particular, the exploding of wires and foils and their interactions with high explosives are of particular interest. The facility combines high-speed electronic framing and streak cameras with the appropriate specialized optics, spectrographs, and laser illumination to record events with a few nanoseconds and micrometers of temporal and spatial resolutions, respectively. Velocity and spectral data are also used to compute pressures with better than kilobar resolution. 3 refs., 16 figs.

57183 **(UCRL—98636) A personal computer database for instrument calibration and maintenance management.** Trombino, D.G. (Lawrence Livermore National Lab., CA (USA)). 26 Sep 1988. Contract W-7405-ENG-48. 10p. (CONF-881232—8). NTIS, PC A03/MF A01. Order Number DE89001131/JAW.

From 22. health physics midyear topical meeting on instrumentation; San Antonio, TX, USA (4 Dec 1988).

It is Lawrence Livermore National Laboratory policy to calibrate more than 1500 portable radiation survey instruments every nine months. To comply with ANSI N323-1978, which requires calibration and maintenance records for each instrument serviced, a computer database system is useful. Our system uses the commercially available Paradox software with an IBM Personal Computer. Current status information for each instrument and maintenance history is now easily accessible. This information includes: most recent calibration date, location, repairs done, and identification of the service technician. Routine monthly reports listing instruments due for servicing, and semi- annual reports showing complete inventories are generated. Statistical information such as excessive repair frequency and average age of equipment can also be prepared. 2 refs., 4 figs., 2 tabs.

57184 **(UCRL—98763) A systematic study of high temperature superconductivity by positron annihilation spectroscopy.** Jean, Y.C.; Nakanishi, H.; Kyle, J.; Wang, S.J.; Turchi, P.E.A.; Howell, R.H.; Wachs, A.L.; Fluss, M.J.; Meng, R.L.; Hor, H.P. (Lawrence Livermore National Lab., CA (USA)). Aug 1988. Contract W-7405-ENG-48. 3p. (CONF-8808122—8). NTIS, PC A02/MF A01. Order Number DE88016974/JAW.

From 8. international conference on positron annihilation; Gent, Belgium (29 Aug 1988).

We report a summarized result of systematic study of positron lifetime and Doppler broadening due to positron--electron annihilation energy spectra in a variety of known superconductors: Type I-Pb, Type II-V_3Si, La(214) 33K, Y(123) 90K, and Tl(2223) 124K perovskite superconductors. 9 refs., 5 figs.

57185 **(UCRL—99306) Ultra-high velocity, HE-driven projectile launchers.** Glenn, L.A. (Lawrence Livermore National Lab., CA (USA)). 29 Jul 1988. Contract W-7405-ENG-48. 29p. (CONF-881093—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015429/JAW.

From Nuclear explosives code developer's conference; Boulder, CO, USA (11 Oct 1988).

A new computer code, called IGUN, has been developed to study the limitations, or constraints on the design, of guns for launching hypervelocity projectiles. IGUN is an arbitrary Lagrange-Eulerian (ALE) code that solves the equations of motion in one dimension, but takes into account arbitrary flow cross section, including discontinuities, and gasdynamic wall drag. The code also features the ability to use pushers with real constitutive models (with strength), generalized tabular equations of state, and a coupled wall motion algorithm that allows gun barrel walls to move in response to the developing internal pressure (conserving momentum and energy in the process). After validating the code with available experimental data, parametric calculations were performed to evaluate the performance of single-stage implosion guns with both hemispherical and Voitenko-like pushers. Preliminary results indicate that a Voitenko device, using helium as the working fluid, and a tested pusher arrangement, can accelerate a projectile to 30 km/s. Potential difficulties and new design concepts are discussed.

57186 **(UCRL—99354) The Leitz QUINDOS coordinate measuring machine process.** Frank, R.N. (Lawrence Livermore National Lab., CA (USA)). 4 Aug 1988. Contract W-7405-ENG-48. 26p. (CONF-8808132—1). NTIS, PC A03/MF A01. Order Number DE88016276/JAW.

From Interagency Mechanical Operations Group gaging subgroup coordinate measurement machine users seminar; Oak Ridge, TN, USA (9 Aug 1988).

QUINDOS is a software system developed by Ernst Leitz Wetzler GmbH of the Federal Republic of Germany as an analytical and control system for coordinate measuring machines. The system is operating on a Leitz 12-10-6 precision measuring machine

in the main inspection shop at Lawrence Livermore Laboratory. The QUINDOS Program is a sophisticated process which provides the user with a challenging degree of freedom. An EDT-like editor is used to build the program which is executable at random. Each program line may contain a holographic volume of information or be a call to a subroutine, which in QUINDOS, is called a procedure. Program execution is moderated through the use of fortran-like loops and conditional branching statements. A full selection of math functions and variables can interact with a variety of geometric pattern functions to create evenly distributed arrays of probing points. The gathering of data is further enhanced by the 3D scanning abilities of the QUINDOS system. Data analysis of standard geometric elements is enhanced through interation control of parameters, such as fixing the origin of a circle and fitting only the radius. Two dimensional analysis is achieved through spline fit comparisons. Three dimensional analysis of part profile is achieved through the direct comparison of nominal and measured points. Output formats, like most everything in QUINDOS, are under the control of the programmer. The degree of control is largely determined by the knowledge and volition of the programmer rather than by the limitations of the system.

57187 **(UCRL—99483) Current status of the NAVSEA synchronous scanning laser-imaging system.** Kulp, T.J.; Garvis, D.; Kennedy, R.; McRae, T.G. (Lawrence Livermore National Lab., CA (USA)). Aug 1988. Contract W-7405-ENG-48. 9p. (CONF-8808133—1). NTIS, PC A02/MF A01. Order Number DE88017013/JAW.

From SPIE conference on underwater imaging; San Diego, CA, USA (15 Aug 1988).

This paper constitutes an update on our efforts to develop an underwater laser-based imaging system (UWLIS). The work is being performed under contract from the Naval Sea Systems Command Office of Salvage and Diving (NAVSEA/OOC) in order to provide instrumentation that will improve the visibility range available to deep-ocean (1500--6000 m) submersible vehicles during ocean-floor search-and-salvage operations. In general, these submersibles are remotely operated vehicles (ROV) that currently employ high-intensity floodlights and low-light-level TV cameras to produce video images of the seafloor, which are relayed to the mother ship to allow target identification. Often, these floodlight based systems require that the ROV come within 6 to 10 m of the target in order to positively identify it. This poses both a risk of damaging the vehicle on outcropping seafloor terrain features and an increase in mission cost due to the time lost on maneuvering to identify false targets. Given that salvage-operation costs typically range from $1000 to $3000 per hour, a system that would improve the visibility range from 10 to 100 m would save thousands of dollars and greatly increase the probability of success of these missions. 7 refs., 9 figs.

57188 **Thermocouple mounting on semiconductor samples.** Blair, D.S.; Fowler, G.L. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* **6**: No. 6, 3164-3166(Nov 1988).

We have designed an alternate method of attaching a thermocouple to a semiconductor which is both simple and reliable. It consists of a tungsten base alloy thermocouple threaded through a hole in the sample and held in place by a tantalum strap. (AIP)

57189 **Superconducting coaxial transmission line for dilution refrigerators.** Yucel, S.; Alexander, N.; Honig, A. (Syracuse University, Physics Department, Syracuse, New York 13244). *Review of Scientific Instruments;* **59**: No. 10, 2276-2278(Oct 1988).

A novel helium-gas-filled coaxial insert sealed with ceramic feedthroughs, which thermally grounds the superconducting niobium inner conductor of a coaxial transmission line at the 1.3-K pot of a dilution refrigerator, is described. This transmission line—insert combination overcomes the large heat leak associated with room temperature coaxial access to a dilution refrigerator and results in relatively unperturbed broadband transmission of radio-frequencies from room temperature to the mixing chamber, with a heat load of less than 1 μW. Two such lines are used to access a cw NMR system incorporated in an Oxford Instruments model 200 top-loading dilution refrigerator, resulting in a rise of the base temperature from 10 mK up to 12 mK. The thermal impedance of the insert with and without helium is analyzed between 1.5 and 6 K; it is shown that the heat leak can be further reduced by an order of magnitude with relatively minor modifications.

57190 **Strong permanent magnet-assisted electromagnetic undulator.** Halbach, K. (to Dept. of Energy, Washington, DC). US Patent 4,761,584. 2 Aug 1988. Filed date 30 Jan 1987. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes an undulator wherein electromagnet poles are located along opposite sides of a particle beam axis normal to the beam axis with alternate north and south poles on each side of the beam to cause the beam to wiggle or undulate as it travels generally along the beam axis, the improvement which comprises reducing the saturation of the electromagnet poles by the use of permanent magnets spaced in between adjacent electromagnetic poles on each side of the axis of the particle beam in an orientation wherein the north and south poles of the permanent magnets are parallel to the particle beam axis and normal to the magnetic axes of the electromagnetic poles to reduce the saturation of the electromagnets to thereby permit the increasing of the field strength of the electromagnets beyond normal saturation levels.

57191 **Sectional device handling tool.** Candee, C.B. (to Dept. of Energy, Washington, DC). US Patent 4,756,656. 12 Jul 1988. Filed date 3 Mar 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A sectional apparatus for remotely handling a device in an irradiated underwater environment is described. The apparatus comprising: an elongated structure including one or more elongated structural sections. Each of the sections carries a control line segment. Each of the sections includes first and second coupling means respectively mounted at opposite ends thereof, all of the first coupling means being substantially identical to one another, all of the second coupling means being substantially identical to one another, each of the first coupling means being mateable and connectable with each of the second coupling means for interconnecting the sections and the control line segments thereof in end-to-end relationship to form the structure with the control line segments cooperating to form a control line. The second coupling means at one end of the structure are connectable to the associated device for support thereof and for connecting the control line thereto. The support means include the second coupling means connected to the first coupling means at the other end of the structure, the support means including means for connecting the control line to associated control means for controlling the operation of the device.

57192 **Forward and reverse control system for induction motors.** Wright, J.T. US Patent Application 6-096,435. 15 Sep 1987. 11p. Contract AC04-76DP00789. NTIS, PC A03/MF A01.

A control system for controlling the direction of rotation of a rotor of an induction motor includes an array of five triacs with one of the triacs applying a current of fixed phase to the windings of the rotor and four of the triacs being switchable to apply either hot ac current or return ac current to the stator windings so as to reverse the phase of current in the stator relative to that of the rotor and thereby reverse the direction of rotation of the rotor. Switching current phase in the stator is accomplished by operating the gates of pairs of the triacs so as to connect either hot ac current or return ac current to the input winding of the stator. 1 fig.

57193 **A system for tranmitting low frequency analog signals over ac power lines.** Baker, S.P.; Durall, R.L.; Haynes, H.D. US Patent Application 6-079,614. 30 Jul 1987. 22p. Contract AC05-84OR21400. NTIS, PC A03/MF A01.

A system for transmitting low frequency analog signals over ac power lines using FM modulation. A low frequency analog signal to be transmitted is first applied to a voltage-to-frequency converter where it is converted to a signal whose frequency varies in proportion to the analog signal amplitude. This signal is then used to modulate the carrier frequency of an FM transmitter coupled to an ac power line. The modulation signal frequency range is

selected to be within the response band of the FM transmitter. The FM modulated carrier signal is received by an FM receiver coupled to the ac power line, demodulated and the demodulated signal frequency is converted by a frequency-to-voltage converter back to the form of the original low frequency analog input signal. 4 figs.

57194 **Remotely serviced filter and housing.** Ross, M.J.; Zaladonis, L.A. US Patent Application 6-076,442. 22 Jul 1987. 12p. Contract AC07-84ID12435. NTIS, PC A03/MF A01.

A filter system for a hot cell comprises a housing adapted for input of air or other gas to be filtered, flow of the air through a filter element, and exit of filtered air. The housing is tapered at the top to make it easy to insert a filter cartridge holds the filter element while the air or other gas is passed through the filter element. Captive bolts in trunnion nuts are readily operated by electromechanical manipulators operating power wrenches to secure and release the filter cartridge. The filter cartridge is adapted to make it easy to change a filter element by using a master-slave manipulator at a shielded window station. 6 figs.

57195 **Current-level triggered plasma-opening switch.** Mendel, C.W. US Patent Application 6-067,027. 29 Jun 1987. 17p. Contract AC04-76DP00789. NTIS, PC A03/MF A01.

An opening switch for very high power electrical pulses uses a slow magnetic field to confine a plasma across a gap between two electrodes. The plasma conducts the electric pulse across the gap while the switch is closed. A magnetic field generated by the pulse repels the slow magnetic field from the negative electrode to push the plasma from the electrode, opening the switch. A plurality of radial vanes may be used to enhance the slow magnetic field. 5 figs.

57196 **Functional relationship-based alarm processing.** Corsberg, D.R. US Patent Application 6-037,897. 13 Apr 1987. 32p. Contract AC07-76ID01570. NTIS, PC A03/MF A01.

A functional relationship-based alarm processing system and method analyzes each alarm as it is activated and determines its relative importance with other currently activated alarms and signals in accordance with the relationships that the newly activated alarm has with other currently activated alarms. Once the initial level of importance of the alarm has been determined, that alarm is again evaluated if another related alarm is activated. Thus, each alarm's importance is continuously updated as the state of the process changes during a scenario. Four hierarchical relationships are defined by this alarm filtering methodology: (1) level precursor (usually occurs when there are two alarm settings on the same parameter); (2) direct precursor (based on causal factors between two alarms); (3) required action (system response or action expected within a specified time following activation of an alarm or combination of alarms and process signals); and (4) blocking condition (alarms that are normally expected and are not considered important). 11 figs.

57197 **Magnetic reconnection launcher.** Cowan, M. US Patent Application 6-034,354. 6 Apr 1987. 33p. Contract AC04-76DP00789. NTIS, PC A03/MF A01.

An electromagnetic launcher includes a plurality of electrical stages which are energized sequentially in the launcher with the passage of a projectiles. Each stage of the launcher includes two or more coils which are arranged coaxially on either closed-loop or straight lines to form gaps between their ends. The projectile has an electrically conductive gap-portion that passes through all the gaps of all the stages in a direction transverse to the axes of the coils. The coils receive an electric current, store magnetic energy, and convert a significant portion of the stored magnetic energy into kinetic energy of the projectile moves through the gap. The magnetic polarity of the opposing coils is in the same direction, e.g. N-S-N-S. A gap portion of the projectile may be made from aluminum and is propelled by the reconnection of magnetic flux stored in the coils which causes accelerating forces to act upon the projectile and at the horizontal surfaces of the projectile near its rear. The gap portion of the projectile may be flat, rectangular and longer than the length of the opposing coils. The gap portion of the projectile permits substantially unrestricted distribution of the induced currents so that current densities are only high where the useful magnetic force is high. This allows designs which permit ohmic oblation from the rear surfaces of the gap portion of the projectile allowing much high velocities to be achieved. An electric power apparatus controls the electric power supplied to the opposing coils until the gap portion of the projectile substantially occupies the gap between the coils, at which time the coils are supplied with peak current quickly. 8 figs.

57198 **Method of fabricating optical waveguides by ion implantation doping.** Appleton, B.R.; Ashley, P.R.; Buchal, C.J. US Patent Application 6-029,570. 24 Mar 1987. 16p. Contract AC05-84OR21400. NTIS, PC A03/MF A01.

A method for fabricating high-quality optical waveguides in optical quality oxide crystals by ion implantation doping and controlled epitaxial recrystallization is provided. Masked $LiNbO_3$ crystals are implanted with high concentrations of Ti dopant at ion energies of about 360 keV while maintaining the crystal near liquid nitrogen temperature. Ion implantation doping produces an amorphous, Ti-rich nonequilibrium phase in the implanted region. Subsequent thermal annealing in a water-saturated oxygen atmosphere at up to 1000{degree}C produces solid-phase epitaxial regrowth onto the crystalline substrate. A high-quality crystalline layer results which incorporates the Ti into the crystal structure at much higher concentrations than is possible by standard diffusion techniques, and this implanted region has excellent optical waveguiding properties.

4203 Lasers

REFER ALSO TO CITATION(S) 57014, 57056, 57234, 57414, 57415

57199 **(AD-A—194858/7/XAB) Low-threshold GaAs/AlGaAs lasers grown on Si by organometallic vapor-phase epitaxy.** Choi, H.K.; Lee, J.W.; Salerno, J.P.; Connors, M.K.; Tsaur, B.Y. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 4 Apr 1988. 3p. (JA—6064). NTIS, PC A02/MF A01.

Pub. in Applied Physics Letters, Vol. 52, No. 14, 1114-1115(4 Apr 1988).

Low-threshold double-heterostructure ridge-waveguide lasers were fabricated in GaAs/A1GaAs layers grown on Si by organometallic vapor phase epitaxy. The pulsed threshold current of the best ridge-waveguide laser is 50 mA, with differential quantum efficiency of about 9% per facet. Broad-area lasers fabricated on the same wafer have pulsed threshold current densities as low as 300 A/sq. cm.

57200 **(AD-A—194860/3/XAB) Spatial-mode-matching efficiencies for heterodyned GaAlAs semiconductor lasers.** Winick, K.A.; Kumar, P. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). Apr 1988. 10p. (JA—5978). NTIS, PC A02/MF A01.

Pub. in Jnl. of Lightwave Technology, Vol. 6, No. 4, 513-520(Apr 1988).

High spatial-mode-matching efficiencies are experimentally demonstrated when open-loop frequency-stabilized GaAlAs semiconductor lasers are heterodyned on silicon p-i-n detectors. Repeatable values of 75% are obtained using two independent lasers. The mode-matching efficiency increases to 90% when a single modulated laser is self-heterodyned using an unequal-path-length Mach-Zehnder interferometer. Experimental data are shown to match closely with theoretical predictions.

57201 **(AD-A—195126/8/XAB) Gas-laser frequency control for passive cavity-ring gyros.** Lorenz, M.A.; Rotge, J.R.; Biezad, D.J. (Air Force Academy, CO (USA). Frank J. Seiler Research Lab.). Feb 1988. 7p. (FJSRL-JR—88-0004). NTIS, PC A02/MF A01.

Pub. in Jnl. of Guidance, Control and Dynamics, Vol. 11, No. 1, 66-71(Jan-Feb 1988).

The frequency stability of a helium-neon laser can be significantly enhanced by locking the laser's frequency to a resonance of an optical cavity. This frequency stabilization is achieved by electronic feedback and sensor control of the laser's cavity length and

discharge current. The frequency-locking technique described in this paper may be applied to passive resonant ring gyros and toward improving frequency standards and length measurements. When this technique was applied to a 169-cm^2 passive cavity, a random error of 0.0078 Earth rate units was obtained, with a 10 s averaging time. Although the performance of this instrument is about one order of magnitude above the shot noise limit, extrapolation of this performance to proposed large passive resonant-ring gyros indicates the desired sensitivity for precision-rate sensor testing, geophysical investigations, and relativity experiments is attainable.

57202 **(AD-A—195169/8/XAB) Transition-radiation experiment to measure the electron-beam modulation induced by the free-electron laser: a design study. Master's thesis.** Joynson, J.E. (Naval Postgraduate School, Monterey, CA (USA)). Dec 1987. 90p. NTIS, PC A05/MF A01.

The modulated beam of the free-electron laser when passed through a thin target should produce strong transition radiation. The measurement of the transition radiation is a direct measurement of the electron-beam modulation in the free-electron laser. A transition radiation experiment using the Stanford MKIII Infrared Free-Electron Laser (IRFEL) has been proposed. The analysis has centered on TRANSPORT, a computer program used for designing charged-particle beam systems. The MKIII IRFEL wiggler exit-bending-magnet system was modeled using TRANSPORT. Analysis reveals that the transverse-emittance and momentum-spread characteristics will cause the modulated beam to demodulate along the path of the central trajectory. A detector location 10 millimeters downstream of the first bending magnet is found suitable for the measurement of the electron beam modulation. For this case the thin foil must be rotated approximately 11.25° about the y axis to yield a minimum effective picobunch extent as seen by the thin foil. Alternate FEL systems are suggested for investigation.

57203 **(AD-A—195339/7/XAB) Research on a two-stage free-electron laser oscillator. Final report.** (Berkeley Research Associates, Inc., CA (USA)). Mar 1988. 91p. (BRA—88-W034R). NTIS, PC A05/MF A01.

This research involved the theoretical and numerical analysis of the physics of free-electron lasers using relativistic particle beams. The major emphasis was to obtain design criteria for development of a two-stage FEL oscillator operating in the trapped-particle mode. The work was centered on the development of a fully relativistic, nonlinear analysis of the spatial and temporal evolution of multiple modes within a free-electron laser oscillator and of a large-amplitude, nonlinearly saturated state characteristic of trapped-particle-mode operation. The equations solved are the Maxwell equations of electrodynamics coupled with the collisionless Boltzmann equation that describes collisionless particles under influence of the electromagnetic fields. The electromagnetic fields include the radiation fields from the FEL and the self-electric fields from the longitudinal potential due to the space charge, i.e., the dominant component of the interparticle Coulomb forces. The particle dynamics transverse to the magnetic axis are included, but gradients in the radiation fields are ignored. The electron-beam equilibrium is assumed to be spatially uniform and temporally stationary. Justification and probable impact of further approximations are discussed. The approximations employed are consistent with the purpose of obtaining experimentally implementable design criteria for the FEL oscillator.

57204 **(AD-A—195341/3/XAB) NBS-NRL free-electron laser facility for the annual MFEL Contractors Meeting (3rd) held in Utah on 16-18 May 1988. Progress report.** (National Bureau of Standards, Washington, DC (USA)). 18 May 1988. 7p. NTIS, PC A02/MF A01.

Design and construction has began for the NBS-NRL Free Electron Laser (FEL) Facility, which will be based on the NBS-LANL continuous-wave Racetrack Microtron (RTM) accelerator. The conceptual design of the facility is now complete, the RTM is nearing completion, and final negotiations with a wiggler contractor are underway.

57205 **(AD-A—195371/0/XAB) Analysis of free-electron laser performance utilizing the National Bureau of Standards' c-w microtron.** Tang, C.M.; Sprangle, P.; Penner, S.; Maruyama, X.K. (National Bureau of Standards, Washington, DC (USA)). 1987. 15p. NTIS, PC A03/MF A01.

The c-w racetrack microtron (RTM) will be utilized as a driver for a free-electron laser (FEL) oscillator. The RTM possesses many exceptional properties of value for the FEL: i) CW operation, ii) energy from 20 to 185 MeV, iii) small energy spread and emittance, iv) excellent energy stability, and v) high average power. The 1-D FEL gain formula predicts that the FEL would oscillate at the fundamental approximately from 0.25 to 10 micrometer when up-grading the peak current to $>$ or $=$ 2 A. This paper presents 3-D self-consistent numerical results including several realistic effects, such as emittance, betatron oscillations, diffraction, and refraction. The results indicate that the design value of the transverse emittance is small enough that it does not degrade the FEL performance for intermediate to long wavelengths, and only slightly degrades the performance at the shortest wavelength under consideration. Due to the good emittance, the current density is high enough that focusing, or guiding, begins to manifest itself for wavelengths $>$ 2.0 micrometers.

57206 **(LA-UR—88-2569) Subpicosecond, high-brightness excimer laser systems.** Taylor, A.J.; Gosnell, T.R.; Roberts, J.P.; Lester, C.S.; Gibson, R.B.; Harper, S.E.; Tallman, C.R. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 4p. (CONF-8807105—1; CONF-8807106—1). NTIS, PC A02/MF A01. Order Number DE88016239/JAW.

From International conference on ultrafast phenomena '88; Kyoto, Japan (12 Jul 1988).

Subpicosecond, high-brightness excimer laser systems are being used to explore the interaction of intense coherent ultraviolet radiation with matter. Applications of current systems include generation of picosecond x-ray pulses, investigation of possible x-ray laser pumping schemes, studies of multiphoton phenomena in atomic species, and time-resolved photochemistry. These systems, based on the amplification of subpicosecond pulses in small aperture ({approximately}1 cm^2) XeCl or KrF amplifiers, deliver focal spot intensities of {approximately}10^{17} W/cm^2. Scaling to higher intensities, however, will require an additional large aperture amplifier which preserves near-diffraction-limited beam quality and subpicosecond pulse duration. We describe here both a small aperture KrF system which routinely provides intensities $>10^{17}$ W/cm^2 to several experiments, and a large aperture XeCl system designed to deliver {approximately}1 J subpicosecond pulses and yield intensities on target in excess of 10^{19}W/cm^2. We also discuss the effects of two-photon absorption on large-aperture, high-brightness excimer lasers. 4 refs., 2 figs.

57207 **(LA-UR—88-3006) Transverse resistive-wall instability of a bunched electron beam in a wiggler.** Rangarajan, G.; Chan, K.C.D. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 4p. (CONF-881049—4). NTIS, PC A02/MF A01. Order Number DE89000370/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

The transverse motion of a beam traversing a narrow beam pipe is modified by resistive-wall effects. Depending on the strength of the focusing force from the alternating wiggler field, the effect ranges from a modification of the oscillation to a growth in transverse displacement with the length of pipe. This transverse effect saturates after a number of bunches have passed. The saturated transverse effect depends only on the pipe radius b (it increases as $1/b^2$), but is independent of the thickness {tau} and conductivity σ of the pipe. However, {tau} and σ affect the time needed to attain saturation. 5 refs., 2 figs.

57208 **(SAND—88-2507C) High-energy uv laser experiments.** Adams, R.G.; Frost, C.A.; Clark, B.F.; Jojola, J.M.; Dew, D.A.; Leija, J.; Dillon, M.M. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 7p. (CONF-8809149—1). NTIS, PC A02/MF A01. Order Number DE89000505/JAW.

From DARPA/SDIO services annual propagation review; Newport, RI, USA (12 Sep 1988).

A pulsed, high-energy (>5 J) KrF ultraviolet laser system has been developed and used in initial conditioning cell experiments with the IBEX 4-MV electron beam accelerator. High currents (35 kA) have been efficiently and stably transported in a 1-cm-diameter beam through low-pressure diethylaniline (DEA) vapor. Conditioning cell details, laser-accelerator parameters, and initial transport results are discussed. 5 refs., 4 figs.

57209 **(UCID—21479) Results of ASM [Axially Symmetric Magnetic] gauge tests performed on the LLNL Phoenix Laser.** Radousky, H.B.; Gerassimenko, M. (Lawrence Livermore National Lab., CA (USA)). Aug 1988. Contract W-7405-ENG-48. 15p. NTIS, PC A03/MF A01. Order Number DE89001018/JAW.

Axially Symmetric Magnetic gauges were tested on the Phoenix Laser. It was found that new shielding techniques which were developed reduced substantially the noise generated by the impact, with respect to the designs used previously on an LLNL UGT. 3 refs., 9 figs.

57210 **Linear theory of a sheet beam free electron laser.** Antonsen T.M. Jr.; Latham, P.E. (Department of Electrical Engineering and the Laboratory for Plasma Research, University of Maryland, College Park, Maryland 20742). *Physics of Fluids;* **31**: No. 11, 3379-3386(Nov 1988).

The linear theory of a free electron laser based on a sheet beam propagating in a narrow gap is developed. The three-dimensional structure of the radiation field is determined for an infinitely thin sheet beam. Included are the effects of diffraction and space charge. The possibility of diffractive suppression of unwanted modes is discussed.

57211 **Surface-emitting, multiple quantum well GaAs/AlGaAs laser with wavelength-resonant periodic gain medium.** Raja, M.Y.A.; Brueck, S.R.J.; Osin-acute-accentski, M.; Schaus, C.F.; McInerney, J.G.; Brennan, T.M.; Hammons, B.E. (Center for High Technology Materials, University of New Mexico, Albuquerque, New Mexico 87131). *Applied Physics Letters;* **53**: No. 18, 1678-1680(31 Oct 1988).

A novel surface-emitting semiconductor laser with a vertical resonator, extremely short gain length, and enhanced gain at a specific design wavelength has been demonstrated. The gain medium consists of a series of GaAs quantum wells separated by AlGaAs spacers whose thicknesses are chosen to be one-half the wavelength of a particular transition in the quantum wells. This structure forces the antinodes of the standing-wave optical field to coincide with the gain elements, enhancing the gain and frequency selectivity in the vertical direction and substantially reducing amplified spontaneous emission. We have achieved optically pumped lasing with a threshold of 6 MW/cm^3 at room temperature in a molecular beam epitaxially grown structure of thickness 4.3 μm, of which only 320 nm provided gain.

57212 **How the military responded to the laser.** Seidel, R.W. (Research Historian at the Laser History Project, in Los Alamos, New Mexico). *Physics Today;* **41**: No. 10, 36-43(Oct 1988).

A 'cash and crash' approach and interservice competition led to a premature shift of emphasis from research and exploration to development and scaling-up.

57213 **High power picosecond laser system at 248 nm.** Tighe, W.; Nam, C.H.; Robinson, J.; Suckewer, S. (Princeton Plasma Physics Laboratory, Princeton, New Jersey 08543). *Review of Scientific Instruments;* **59**: No. 10, 2235-2240(Oct 1988).

We describe a powerful picosecond KrF* laser system consisting of a synchronously pumped dye oscillator, a three-stage dye amplifier, frequency conversion to 248 nm, and amplification through a series of excimer modules. Characteristics are given at each stage of the system. With the first stage of the system complete, a focused intensity of ~10^{16} W/cm^2 is obtained. Initial visible spectra obtained by interaction with various targets are presented.

57214 **Polarization feedback laser stabilization.** Esherick, P.; Owyoung, A. US Patent Application 6-101,535. 28 Sep 1987. 15p. Contract AC04-76DP00789. NTIS, PC A03/MF A01.

A system for locking two Nd:YAG laser oscillators includes an optical path for feeding the output of one laser into the other with different polarizations. Elliptical polarization is incorporated into the optical path so that the change in polarization that occurs when the frequencies coincide may be detected to provide a feedback signal to control one laser relative to the other. 4 figs.

57215 **Semiconductor devices incorporating multilayer interference regions.** Biefeld, R.M.; Drummond, T.J.; Gourley, P.L.; Zipperian, T.E. US Patent Application 6-091,560. 31 Aug 1987. 25p. Contract AC04-76DP00789. NTIS, PC A03/MF A01.

A semiconductor high reflector comprising a number of thin alternating layers of semiconductor materials is electrically tunable and may be used as a temperature insensitive semiconductor laser in a Fabry-Perot configuration. 8 figs.

57216 **Fusion pumped laser.** Pappas, D.S. US Patent Application 6-079,961. 31 Jul 1987. 10p. Contract W-7405-ENG-36. NTIS, PC A03/MF A01.

The apparatus of this invention may comprise a system for generating laser radiation from a high-energy neutron source. The neutron source is a tokamak fusion reactor generating a long pulse of high-energy neutrons and having a temperature and magnetic field effective to generate a neutron flux of at least 10^{15} neutrons/cm^2{center←dot}s. Conversion means are provided adjacent the fusion reactor at a location operable for converting the high-energy neutrons to an energy source with an intensity and energy effective to excite a preselected lasing medium. A lasing medium is spaced about and responsive to the energy source to generate a population inversion effective to support laser oscillations for generating output radiation. 2 figs., 2 tabs.

57217 **Variable laser attenuator.** Foltyn, S.R. US Patent Application 6-055,275. 29 May 1987. 17p. Contract W-7405-ENG-36. NTIS, PC A03/MF A01.

The disclosure relates to low loss, high power variable attenuators comprising one or more transmissive and/or reflective multilayer dielectric filters. The attenuator is particularly suitable to use with unpolarized lasers such as excimer lasers. Beam attenuation is a function of beam polarization and the angle of incidence between the beam and the filter and is controlled by adjusting the angle of incidence the beam makes to the filter or filters. Filters are selected in accordance with beam wavelength. 9 figs.

57218 **Method and apparatus for producing durationally short ultraviolet or x-ray laser pulses.** MacGowan, B.J.; Matthews, D.L.; Trebes, J.E. US Patent Application 6-046,020. 5 May 1987. 22p. Contract W-7405-ENG-48. NTIS, PC A03/MF A01.

A method and apparatus is disclosed for producing ultraviolet or x- ray laser pulses of short duration. An ultraviolet or x-ray laser pulse of long duration is progressively refracted, across the surface of an opaque barrier, by a streaming plasma that is produced by illuminating a solid target with a pulse of conventional line focused high power laser radiation. The short pulse of ultraviolet or x-ray laser radiation, which may be amplified to high power, is separated out by passage through a slit aperture in the opaque barrier.

57219 **Gas mixtures for spark gap closing switches.** Christophorou, L.G.; McCorkle, D.L.; Hunter, S.R. US Patent Application 6-016,904. 20 Feb 1987. 16p. Contract AC05-84OR21400. NTIS, PC A03/MF A01.

Gas mixtures for use in spark gap closing switches comprised of fluorocarbons and low molecular weight, inert buffer gases. To this can be added a third gas having a low ionization potential relative to the buffer gas. The gas mixtures presented possess properties that optimized the efficiency spark gap closing switches. 6 figs.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 56170, 57268

57220 **(AD-A—195223/3/XAB) Experimental and analytical study of two-phase flow in zero gravity. Final report, September 1985-October 1987.** Abdollahian, D.; Grief, R.; Carey, V.P.; Li-Ping, W. (Levy (S.), Inc., Campbell, CA (USA)). Mar 1988. 147p. (SLI—8707). NTIS, PC A07/MF A01.

More-effective and -efficient thermal-transport techniques will be needed for heat rejection from equipment on satellites. Circulating two-phase fluid loops were suggested and laboratory tested for possible application in the above areas. In comparison to a single-phase loop, the two-phase system operates at considerably smaller flow rates and maintains a tighter temperature control with higher heat-transfer coefficients. However, the two-phase fluid-flow regimes, pressure gradients, and heat-transfer coefficients must be evaluated for application in the weightless environment of an orbiting satellite. This projecting studies two-phase flow behavior under zero-gravity conditions. The overall objectives of this study were to generate a data base for two-phase pressure drop and the void-quality relationship under simulated zero gravity conditions and to develop analytical models to predict these parameters for bubbly and annular flow. The simulation of zero-gravity two-phase flow was achieved by using two immiscible liquids with equal densities to eliminate the buoyancy component. Although this approach does not eliminate the gravity effects, it provides a representation for void distribution in the absence of gravity. The modeling effort is limited to developing relations for the two-phase friction multiplier and void-quality relation under bubbly and annular-flow conditions. The bubbly flow model is based on the assumption of local homogeneous conditions between the phases but allows for void distribution in the radial direction. Separated-flow conservation equations are used, and single-phase turbulent flow eddy diffusivity relations are employed.

57221 (INIS-SU—38/A, pp 53-55) **Effect of gas impurities in coolants of supercritical pressure on the heat transfer laws.** Kurganov, V.A.; Ankudinov, V.B. 1987. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88780178/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 6.

In Physics and technology of nuclear reactors. Scientific-technical collection.

Heat transfer in vertical heated tube to the carbon dioxide turbulent flow of supercritical pressure with different nitrogen impurity concentrations was investigated experimentally. Measurements were conducted for the tube with diameter d=22,67 mm and heat length of 130 d in 100-2400 kg/m/sup 2/s range of flowrate; 7,65 and 9,0 MPq; 10-39 deg C inlet temperature and N≦4% nitrogen concentration. Experiment results showed, that in the nitrigen concentration investigated range the nitrogen impurity effect was inessential in case where heat exchange conditions were satisfied in supercritical or one-phase subcritical ranges. With nitrogen impurity increase higher than the limit value and heat exchange conditions realization during mixture boiling the presence of gas impurity results in heat transfer improvement with subcritical heat fluxes, and with supercritical heat fluxes, in heat transfer abrupt deterioration. Critical heat flux values are essentially lower than thermal loads under which analogous temperature peaks occur in supercritical range. 2 refs.; 2 figs.

57222 (INIS-SU—38/A, pp 56-59) **Effect of closing coefficients in a two-dimensional model of steam-droplet flow on the results of a computation experiment.** Kashcheev, V.M.; Muranov, Yu.V.; Yur'ev, Yu.S. 1987. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88780178/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 6.

In Physics and technology of nuclear reactors. Scientific-technical collection.

The results of numerical computation investigation are presented. The effect of carry over flow inaccurate knowledge and the most probable droplet dimension, used in two-dimensional mathematical model in empirical expression form, on steam-droplet computational characteristics was investigated. The effect of the method of droplet ensemble split into groups and group numbers on computation experiment results was analysed. It was shown, that under multigroup model conditions the flow calculation characteristics depend on the method of ensemble split into groups. It was also determined, that the most optimal split-into-groups method with other conditions being equal leading to minimal deviations of calculated values from experimental data, was the split method by droplet mass segments for each group. A comparison of calculated values with experimental data was made with multi-group and monogroup approximation. It was determined, that when using only one droplet group occured essential distinctions of experimental and calculated values. It was shown, tnat the experimental and calculated values satisfactory coincidence occured with groups number equal to 5-6. 9 refs.; 2 figs.

57223 (INIS-SU—48, pp 27-29) **Investigation of heat transfer intensification at nonuniform circumferential megawatt heat fluxes.** Komendantov, A.S.; Kuzma-Kichta, Yu.A.; Vasil'eva, L.T.; Borisov, A.S. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780011/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; (no.4).

In Thermonuclear synthesis. Scientific-technical collection.

The reseaech is aimed at obtaining experimental data on heat transfer and hydrodynamics in the case of intensifying heat transfer from the tube accepting megawatt thermal loads. The technique of investigation and an experimental device are developed. A copper tube heated by an electron beam from outside and cooled by water from inside is chosen as a working place. The local thermal flux is determined according to the temperature fall in the tube wall which can be rotated relatively to an immovable cathode. Distributions of thermal load and wall temperature in the tube perimeter, coefficients of hydraulic resistance are obtained. 5 refs.; 5 figs.

57224 **(NBI-HE—88-16) Hamiltonian treatment of the statistics of fluid incompressible membranes.** David, F. (Niels Bohr Inst., Copenhagen (Denmark); CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique). (Niels Bohr Inst., Copenhagen (Denmark); Niels Bohr Inst., Copenhagen (Denmark); CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique). Mar 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755244/JAW.

Dirac's formalism for constrained Hamiltonian systems is applied to the statistics of incompressible fluid membranes. The effect of tangential flows is completely taken into account. They are shown to induce large distance correlations between extrinsic curvatures at the classical level, but with a sign opposite to the one previously predicted by Foerster. However, these forces are shown to be screened by thermal undulations. This validates the calculation of the renormalization of the bending rigidity by Peliti and Leibler, which assumes no large distance correlations.

57225 **Steam trap monitor.** Ryan, M.J. US Patent Application 6-045,960. 4 May 1987. 26p. Contract W-31109-ENG-38. NTIS, PC A03/MF A01.

A steam trap monitor positioned downstream of a steam trap in a closed steam system includes a first sensor (a hot finger) for measuring the energy of condensate and a second sensor (a cold finger) for measuring the total energy of condensate and steam in the line. The hot finger includes one or more thermocouples for detecting condensate level and energy, while the cold finger contains a liquid with a lower boiling temperature than that of water. Vapor pressure from the liquid is used to do work such as displacing a piston or bellow in providing an indication of total energy (steam + condensate) of the system. Processing means coupled to and responsive to outputs from the hot and cold fingers subtracts the

former from the latter to provide an indication of the presence of steam downstream from the trap indicating that the steam trap is malfunctioning. 2 figs.

4205 Materials Testing

REFER ALSO TO CITATION(S) 56219, 56654, 56897, 56906, 56951, 56989, 57414

57226 (CEA-CONF—9465) Present status of the disk pressure tests for hydrogen embrittlements. Fidelle, J.P. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France)). 1988. 27p. (CONF-8805206—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754994/JAW.

From International conference on hydrogen and materials; Beijing, China (9 May 1988).

The Disk Pressure Tests (DPT) have been developed considerably. Theoretically: a finite elements mechanical analysis shows the build up of a triaxial stress state already at the beginning of the test, which, with other reasons accounts for the very high sensitivity. Experimentally: for Internal Hydrogen Embrittlement (IHE) e.g. Co, Ti, U alloys, for environment embrittlement due to H/sub 2/ hydrogenated media such as water vapor, alcohol, machining fluids or liquid NH/sub 3/. The range has been expanded considerably: up to 300 MPa and up to 1000/sup 0/C. Very low strain rate - longer than a month - tests have been able to evidence HGE; of FCC alloys where H diffusivity is low for very oxidation -sensitive metals such as Nb and Ta, effects may appear only at somewhat high rates. The relationship between dynamic tests, static and low-cycle fatigue tests has been determined. In a number of instances, including SCC, other techniques and even fracture mechanics have been compared to the DPT and proved at best equivalent and several times, less sensitive than a well conducted DPT. At extreme they could not reproduce the field service phenomenon whereas the DPT did and could also be applied satisfactorily to low yield stress materials. The main rupture aspects have been analysed mechanically and organized in a rational and comprehensive chart based on 12,000 + tests over 15O + materials in different conditions. Comparison of HGE tests and service behaviour of a large variety of materials and industrial equipments has made possible to specify acceptance criteria for industrial service, which, provided the shape of the stress strain curves is not significantly affected, can be expanded to IHE, HE by other fluids than H/sub 2/, 36 refs.

57227 (EGG-M—88153) Process control of GMAW by detection of discontinuities in the molten weld pool. Carlson, N.M.; Kunerth, D.C.; Johnson, J.A. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 8p. (CONF-8808123—1). NTIS, PC A02/MF A01. Order Number DE88016880/JAW.

From Conference on review of progress in quantitative NDE; La Jolla, CA, USA (1 Aug 1988).

The use of ultrasonic sensors to detect discontinuities associated with the molten pool is one phase of a project to automate the welding process. In this work, ultrasonic sensors were used to interrogate the region around the molten/solid interface during gas metal arc welding (GMAW). The ultrasonic echoes from the interface and the molten pool provide information about the quality of the fusion zone and the molten pool. This information can be sent to a controller that can vary the welding parameters to correct the process. Previously ultrasonic shear waves were used to determine if the geometry of the molten/solid interface was indicative of an acceptable weld. In this work, longitudinal waves were used to interrogate the molten weld pool for discontinuities. Unacceptable welding conditions that can result in porosity, incomplete penetration, or undercut were detected. 8 refs., 4 figs.

57228 (EPRI-NP—6033) Stepped frequency imaging for flaw monitoring; Final report. Hildebrand, B.P. (Electric Power Research Inst., Palo Alto, CA (USA); Failure Analysis Associates, Bothell, WA (USA)). Sep 1988. 31p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89000247/JAW.

This report summarizes the results of research into the usefulness of stepped frequency imaging (SFI) to nuclear power plant inspection. SFI is a method for producing ultrasonic holographic images without the need to sweep a two-dimensional aperture with the transducer. Instead, the transducer may be translated along a line. At each position of the transducer the frequency is stepped over a finite preselected bandwidth. The frequency stepped data is then processed to synthesize the second dimension. In this way it is possible to generate images in regions that are relatively inaccessible to two-dimensional scanners. This report reviews the theory and experimental work verifying the technique, and then explores its possible applications in the nuclear power industry. It also outlines how this new capability can be incorporated into the SDL-1000 Imaging System previously developed for EPRI. The report concludes with five suggestions for uses for the SFI method. These are: monitoring suspect or repaired regions of feedwater nozzles; monitoring pipe cracks repaired by weld overlay; monitoring crack depth during test block production; imaging flaws where access is difficult; and imaging flaws through cladding without distortion.

57229 (EPRI-NP—6052) Human performance in nondestructive inspections and functional tests: Final report. Harris, D.H. (Electric Power Research Inst., Palo Alto, CA (USA); Anacapa Sciences, Inc., Santa Barbara, CA (USA)). Oct 1988. 155p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89001530/JAW.

Human performance plays a vital role in the inspections and tests conducted to assure the physical integrity of nuclear power plants. Even when technically-sophisticated equipment is employed, the outcome is highly dependent on human control actions, calibrations, observations, analyses, and interpretations. The principal consequences of inadequate performance are missed or falsely-reported defects. However, the cost-avoidance that stems from addressing potential risks promptly, and the increasing costs likely with aging plants, emphasize that timeliness and efficiency are important inspection-performance considerations also. Human performance issues were studied in a sample of inspections and tests regularly conducted in nuclear power plants. These tasks, selected by an industry advisory panel, were: eddy-current inspection of steam-generator tubes; ultrasonic inspection of pipe welds; inservice testing of pumps and valves; and functional testing of shock suppressors. Information was obtained for the study from industry and plant procedural documents; training materials; research reports and related documents; interviews with training specialists, inspectors, supervisory personnel, and equipment designers; and first-hand observations of task performance. Eleven recommendations are developed for improving human performance on nondestructive inspections and functional tests. Two recommendations were for the more-effective application of existing knowledge; nine recommendations were for research projects that should be undertaken to assure continuing improvements in human performance on these tasks. 25 refs., 9 figs., 1 tab.

57230 (SAND—88-1782C) Shaker shock testing using nonstationary random transients. Paez, T.L.; Baca, T.J. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 17p. (CONF-881076—8). NTIS, PC A03/MF A01. Order Number DE88015847/JAW.

From 59. shock and vibration symposium; Albuquerque, NM, USA (18 Oct 1988).

Shock testing plays a critical role in the development of a wide range of structures. Conducting controlled laboratory shock tests on these structures provides essential data on their ability to survive their operational shock environments. Laboratory test specifications establish equivalence relationships between the actual shock environments and the laboratory shock test inputs. In recent years the electrodynamic shaker has proven itself to be a very versatile machine for applying transients to aerospace components. Shaker control techniques now exist which allow reproduction of shock transients composed of summed deterministic functions (e.g., decaying sinusoids). This paper reports the results of a study in which nonstationary random transients are used as the basis for defining shaker shocks. After describing the test specification and implementation procedures, the paper compares the results of some tests conducted on a simple cantilever beam structure. One test is a direct simulation of a nonstationary random process environment; two other tests represent the shock source using excitations estab-

lished via the method of shock response spectra. The advantages and limitations of each approach are summarized. 11 refs., 9 figs., 2 tabs.

57231 (UCRL—21105) Acoustoelastic evaluation of residual stresses in steel rings: Final report. Johnson, G.C. (Lawrence Livermore National Lab., CA (USA)). Jan 1988. Contract W-7405-ENG-48. 10p. NTIS, PC A02/MF A01. Order Number DE89001536/JAW.

The specific goal of the work as originally proposed was to examine the suitability of this ultrasonic technique for measuring the residual stress in a deformed steel ring, and if feasible, to measure this residual stress. Experimental difficulties have prevented the completion of the latter task, but the basic suitability of the technique has been examined. This report will address the progress made, difficulties encountered, and recommendations for further investigation. 4 figs.

57232 (UCRL—99397) Computer-generated radiographs: An application of solid modeling. Laguna, G.W.; Vickers, D.L. (Lawrence Livermore National Lab., CA (USA)). 10 Aug 1988. Contract W-7405-ENG-48. 13p. (CONF-8810121—2). NTIS, PC A03/MF A01. Order Number DE88016286/JAW.

From Autofact '88; Chicago, IL, USA (30 Oct 1988).

A method is described for generating simulated radiographs from solid models of parts or assemblies. The algorithm used is an extension of a ray-trace algorithm for generating photograph-like images from solid model databases. This paper is an extension of work published earlier and includes simulation of spectral distribution of the radiation source and the mass absorption curves of the materials. The paper examines the parameters involved in creating actual radiographs and discusses what can and cannot be modeled. The extensions increase our confidence in our simulations and enable us to handle parts modeled with multiple materials. 8 refs., 7 figs.

57233 Portable radiography system using a relativistic electron beam. Hoeberling, R.F. US Patent Application 6-099,850. 22 Sep 1987. 19p. Contract W-7405-ENG-36. NTIS, PC A03/MF A01.

A portable radiographic generator is provided with an explosive magnetic flux compression generator producing the high voltage necessary to generate a relativistic electron beam. The relativistic electron beam is provided with target materials which generates the desired radiographic pulse. The magnetic flux compression generator may require at least two conventional explosively driven generators in series to obtain a desired output voltage of at least 1 MV. The cathode and anode configuration of the diode are selected to provide a switching action wherein a high impedance load is presented to the magnetic flux compression generator when the high voltage is being generated, and thereafter switching to a low impedance load to generate the relativistic electron beam. Magnetic flux compression generators can be explosively driven and provided in a relatively compact, portable form for use with the relativistic x-ray equipment. 8 figs.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 56456, 56534, 57015, 57052, 57155, 57168, 57203, 57209, 57291, 57415, 57426, 57445, 58285, 58326, 58340

57234 (AD-A—195208/4/XAB) Measurement of the valence-band discontinuities for molecular organic semiconductor/inorganic semiconductor heterojunctions. So, F.F.; Forrest, S.R. (University of Southern California, Los Angeles (USA)). 18 Apr 1988. 5p. NTIS, PC A02/MF A01.

Pub. in Applied Physics Letter, Vol. 52, No. 16, 1341-1343(18 Apr 1988).

The source of this interest lies in the ability of heterojunctions to control optical fields and charge transport in numerous devices such as semiconductor lasers and photodetectors used in optoelectronic applications. Furthermore, the ability to grow epitaxial materials with atomic-scale precision has led to the realization of multiple quantum-well structures that exhibit a wealth of exciting new physical phenomena, some of which are already finding novel device applications.

57235 (AD-A—195501/2/XAB) Fuel structure and pressure effects on the formation of soot particles in diffusion flames. Annual report, 15 January 1987-14 January 1988. Santoro, R.J. (Pennsylvania State Univ., University Park (USA). Dept. of Mechanical Engineering). 15 Feb 1988. 33p. NTIS, PC A03/MF A01.

During the first year of this grant, efforts were concentrated on examining the effects of fuel molecular structure on soot formation in diffusion flames. Studies involving alkane, alkyne, and aromatic fuel species were studied with specific attention given to the surface growth process. Analysis of these studies has demonstrated a strong fuel structure dependence for the amount of soot formed, the conversion percentage of fuel carbon to soot, and the soot-particle surface area present in these diffusion flames. However, when surface area is taken into account, similar specific surface-growth-rate coefficients are observed for all the fuels studied. These results point to a similar surface growth process for all the fuels. Consistent with premixed flame results, the present studies show a continual decrease in this specific surface-growth-rate coefficient with time. Other effects of fuel structure observed include an acceleration of the inception of soot particles to lower locations and, thus, earlier times in the flame as soot conversion percentage increases. These results also point to the importance of the initial particle inception process which appears to control subsequent soot-particle evolution.

57236 (CONF-860992—4) An overview of microelectronics. Tamosaitis, V. (Institute of Gas Technology, Chicago, IL (USA)). 1986. 6p. Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616. Order Number TI88017158/JAW.

From Integrating microelectronics into gas distribution symposium; Fontana, WI, USA (8 Sep 1986).

Microelectronic devices are finding their way into a wide range of applications, including many in the gas industry. In order to apply this technology to the industry properly, a basic knowledge of device features and limitations is required. The most commonly encountered devices in gas distribution control systems are memories and microprocessors, and it is on the properties of these devices and their applicability to the gas industry that I wish to focus attention. The wide variety of memory devices on the market allows us to select a device that matches our needs. High speed, low power dissipation, and high packing density are all available in today's memory devices, but there are trade-offs to be made among device types and features. It is important that we are cognizant of the trade-offs when we are evaluating microelectronic devices for a particular application. Microprocessors (and their closely related relatives, single-chip microcomputers) are advancing to the point where a very sophisticated system can be constructed from one integrated-circuit chip and a handful of discrete components. This single-chip solution could provide communication, sensor interfacing (analog and digital), decision-making and data collection capabilities, and all system memory. These powerful devices are attractive for gas industry applications because they are constructed using CMOS (Complementary Metal Oxide Semiconductor) technology which seems to be perfectly suited for gas industry use. CMOS technology requires low power, has excellent noise characteristics, and is a pleasure to work with. 4 figs.

57237 (DP—1751) An automated instrument for controlled-potential coulometry: System documentation. Holland, M.K.; Cordaro, J.V. (Savannah River Lab., Aiken, SC (USA)). Jun 1988. Contract AC09-76SR00001. 81p. NTIS, PC A05. Order Number DE89001029/JAW.

An automated controlled-potential coulometer has been developed at the Savannah River Plant for the determination of plutonium. Two such coulometers have been assembled, evaluated, and applied. The software is based upon the methodology used at the Savannah River Plant, however the system is applicable with minimal software modifications to any of the methodologies used throughout the nuclear industry. These state-of-the-art coulometers feature electrical calibration of the integration system, background current corrections, and control-potential adjustment capabilities.

Measurement precision within 0.1% has been demonstrated. The systems have also been successfully applied to the determination of pure neptunium solutions. The design and documentation of the automated instrument are described herein. Each individual module's operation, wiring layout, and alignment are described. Interconnection of the modules and system calibration are discussed. A complete set of system prints and a list of associated parts are included. 9 refs., 10 figs., 6 tabs.

57238 **(LBL—25813) Numerical simulation of experimental data from planar SIS mixers with integrated tuning elements.** Mears, C.A.; Hu, Qing; Richards, P.L. (Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC03-76SF00098. 7p. (CONF-880812—14). NTIS, PC A02. Order Number DE89001259/JAW.

From Applied superconductivity conference; San Francisco, CA, USA (21 Aug 1988).

We have used the full Tucker theory including the quantum susceptance to fit data from planar lithographed mm-wave mixers with bow tie antennas and integrated RF coupling elements. Essentially perfect fits to pumped IV curves have been obtained. The deduced imbedding admittances agree well with those independently calculated from the geometry of the antenna and matching structures. We find that the quantum susceptance is essential to the fit and thus to predictions of the mixer performance. For junctions with moderately sharp gap structures, the quantum susceptance is especially important in the production of steps with low and/or negative dynamic conductance. 15 refs., 4 figs.

57239 **(LBL—25814) MM wave quasioptical SIS mixers.** Hu, Qing; Mears, C.A.; Richards, P.L.; Lloyd, F.L. (Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC03-76SF00098. 7p. (CONF-880812—13). NTIS, PC A02. Order Number DE89001262/JAW.

From Applied superconductivity conference; San Francisco, CA, USA (21 Aug 1988).

We have tested the performance of planar SIS mixers with log-periodic antennas at near millimeter and submillimeter wave frequencies from 90 to 360 GHz. The large ωR/sub N/C product ({approximately}10 at 90 GHz) of our Nb/NbO/sub x//Pb-In-Au junctions requires an integrated inductive tuning element to resonate the junction capacitance at the operating frequencies. We have used two types of integrated tuning element, which were designed with the aid of measurements using a Fourier transform spectrometer. Preliminary results indicate that the tuning elements can give very good mixer performance up to at least 200 GHz. An inductive wire in parallel with a 5-junction array gives a minimum mixer noise temperature of 115K (DSB) at 90 GHz with a FWHM bandwidth of 8 GHz. An open-ended microstrip stub in parallel with a single junction, gives minimum mixer noise temperatures of 150 and 200K (DSB) near 90 and 180 GHz with FWHM bandwidths of 4 and 3 GHz, respectively. The relatively high mixer noise temperatures compared to those of waveguide SIS mixers in a similar frequency range are attributed mainly to the losses in our optical system, which is being improved. 13 refs., 6 figs., 1 tab.

57240 **(PB—88-239918/XAB) Fractal analysis of soot agglomerates. Final report, June 1986-June 1987.** Samson, R.J. (Maryland Univ., College Park (USA)). Jun 1988. 95p. NTIS, PC A05/MF A01.

The fractal behavior of soot agglomerates formed by the combustion of acetylene in a coannular diffusion burner is studied. Structural data from electron micrographs were obtained by two methods: the first by particle counting with the aid of stereopairs for small clusters, and the second by electronic digitization with advanced image-processing techniques, used for the larger agglomerates. An average agglomerate length to width ratio of about 1.7 with a standard deviation of 0.6 was obtained. The agglomerates were found to have a fractal dimension D of about 1.8-1.9 based on measurements of the pair-correlation function for large agglomerates and 1.5-1.6 based on measurements of the radius of gyration for small agglomerates. These results are compared with recent computer simulations as well as experimental studies of inorganic smokes.

57241 **(SAND—88-0272) Developing a connector selection DBMS using NIAM [Nijssen's Information Analysis Methodology].** Sevier, N.E. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1988. Contract AC04-76DP00789. 20p. NTIS, PC A03/MF A01. Order Number DE89001658/JAW.

At Sandia there exist over 1200 qualified electrical connectors that an engineer can chose from for a given application. Currently, engineers select a connector from a small group of familiar connectors. This technique may not select the connector which is best suited for the application. To assist engineers in selecting the most suitable connector from those available, a user friendly, menu driven database was required. Nijssen's Information Analysis Methodology (NIAM), a conceptual information modeling technique, was used to characterize the connector data requirements. NIAM gives the designer techniques for gathering, modeling, and analyzing information. The major benefit of the NIAM was the ability to gain acceptance and approval of the conceptual model from management and users. The conceptual model may then be implemented in any specified database management system. This paper will discuss the development of the connector selection database at Sandia using NIAM. 5 refs., 17 figs., 1 tab.

57242 **(SAND—88-0498) Technology transfer of CABAL-12 glass to support the fabrication of the MC4050 power supply.** Watkins, R.D.; Kovacic, L.; Wengert, P.R.; Douglas, S.C.; Brow, R.K.; Burchett, S.N.; Street, H.K. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1988. Contract AC04-76DP00789. 61p. NTIS, PC A04/MF A01. Order Number DE89001464/JAW.

The CABAL-12 glass technology was successfully transferred to private industry to support the fabrication of ambient-temperature lithium batteries for the MC4050 Power Supply. This report reviews all of the activities conducted, including (1) commercial production of CABAL-12 glass; (2) commercial preform fabrication; (3) corrosion studies of commercial CABAL-12 in both lithium/electrolyte and aqueous environments; (4) stress analyses of headers with CABAL-12 glass; and (5) commercial fabrication of CABAL-12 seals. 14 refs., 22 figs., 12 tabs.

57243 **(SAND—88-1419) Transverter assembly for the advanced instrumentation radar.** Simons, J.M. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1988. Contract AC04-76DP00789. 35p. NTIS, PC A03/MF A01. Order Number DE89001036/JAW.

This report presents a physical description of the S84789 Transverter Assembly which is part of the Advanced Instrument Radar Relay System. The environmental and electrical requirements are also provided along with the descriptions and results of evaluation tests performed to verify the Transverter Assembly design meets all system requirements. All data taken show the Transverter Assembly will perform the required functions as a part of the next assembly. 5 refs., 10 figs., 4 tabs.

57244 **(SAND—88-2318C) Process/performance comparisons of two electroding systems for a perfluorocarbon liquid/plastic film capacitor.** Harris, J.O. Jr.; Delancy, R.W.; Foster, J.C. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 5p. (CONF-8810146—1). NTIS, PC A02/MF A01. Order Number DE88015528/JAW.

From Capacitor and resistor technology symposium; Dusseldorf, F.R. Germany (17 Oct 1988).

Two electroding systems for capacitor rolls are compared; one utilized Ag-epoxy and the other utilized arc-spray terminations. For the required high-peak/high-reversal current discharges, the arc-spray process was clearly superior in both performance (based on destructive tests) and manufacturability/costs. These performance trends were consistent for units fabricated with a wide range of winding tensions and different edge margins. The electroding fabrication processes are briefly described, and the comparative results of short-term breakdown, operational life, and DC life destructive tests re emphasized. 2 refs., 2 figs., 4 tabs.

57245 **(UCID—21491) MSAD actuator solenoid performance evaluation and characterization.** Breitenbucher, P.W.; Gutierrez, D.C.; Payne, A.N.; Zentler, J-M. (Lawrence Livermore National Lab., CA (USA)). Jun 1988. Contract W-7405-ENG-48. 16p. NTIS, PC A03/MF A01. Order Number DE89000601/JAW.

An effort was undertaken to gain an improved understanding of the dynamic and steady-state behavior of the W84 and W87 MSAD actuator solenoids. Solenoid responses to various levels of excitation voltage were measured; and a preliminary, qualitative analysis of these responses was then done. This report summarizes the main results of the effort. 3 refs., 7 figs.

57246 **Magnetic field penetration of erosion switch plasmas.** Mason, R.J.; Jones, M.E.; Grossmann, J.M.; Ottinger, P.F. (Applied Theoretical Physics Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review Letters;* **61**: No. 16, 1835-1838(17 Oct 1988).

Computer simulations demonstrate that the entrainment (or advection) of magnetic field with the flow of cathode-emitted electrons can constitute a dominant mechanism for the magnetic field penetration of erosion switch plasmas. Cross-field drift in the accelerating electric field near the cathode starts the penetration process. Plasma erosion propagates the point for emission and magnetic field injection along the cathode toward the load: for the possibility of rapid switch opening.

57247 **Apparatus and method of preloading vibration-damping bellows.** Cutburth, R.W. (to Dept. of Energy, Washington, DC). US Patent 4,755,025. 5 Jul 1988. Filed date 26 Sep 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A vibration-isolated optical system is described comprising: (a) a generally enclosed optical transmission system including at least first and second light tubes and an enclosed control chamber connected to the light tubes; (b) optical beam control means within the chamber for controlling the path of an optical beam within the light tubes; (c) support means separate from the chamber and extending into the chamber mounting the control means therein; (d) first and second vibration isolation bellows respectively connecting the first and second light tubes to the chamber, the bellows each having an axis generally parallel to each light tube; (e) third vibration isolation bellows mounted between the support means and the chamber; (f) means for applying a vacuum to the chamber, the first, second and third bellows and the light tubes; and (g) means for applying a selected compressive force along the length of each of the first, second and third bellows for offsetting vacuum-generated loads in the bellows.

57248 **Substrate solder barriers for semiconductor epilayer growth.** Drummond, T.J.; Ginley, D.S.; Zipperian, T.E. US Patent Application 6-111,488. 23 Oct 1987. 17p. Contract AC04-76DP00789. NTIS, PC A03/MF A01.

During the growth of compound semiconductors by epitaxial processes, substrates are typically mounted to a support. In molecular beam epitaxy, mounting is done using indium as a solder. This method has two drawbacks: the indium reacts with the substrate, and it is difficult to uniformly wet the back of a large diameter substrate. Both of these problems have been successfully overcome by sputter coating the back of the substrate with a thin layer of tungsten carbide or tungsten carbide and gold. In addition to being compatible with the growth of high quality semiconductor epilayers this coating is also inert in all standard substate cleaning etchants used for compound semiconductors, and provides uniform distribution of energy in radiant heating. 1 tab.

57249 **Test probe for surface mounted leadless chip carrier.** Meyer, K.L.; Topolewski, J. US Patent Application 6-103,865. 2 Oct 1987. 14p. Contract AC04-76DP00613. NTIS, PC A03/MF A01.

A test probe for a surface mounted leadless chip carrier is disclosed. The probe includes specially designed connector pins which allow size reductions in the probe. A thermoplastic housing provides spring action to ensure good mechanical and electrical contact between the pins and the contact strips of a leadless chip carrier. Other features include flexible wires molded into the housing and two different types of pins alternately placed in the housing. These features allow fabrication of a smaller and simpler test probe. 1 fig.

57250 **Transformer coupling for transmitting direct current through a barrier.** Brown, R.L.; Guilford, R.P.; Stichman, J.H. US Patent Application 6-067,026. 29 Jun 1987. 16p. Contract AC04-76DP00789. NTIS, PC A03/MF A01.

The transmission system for transmitting direct current from an energy source on one side of an electrical and mechanical barrier to a load on the other side of the barrier utilizes a transformer comprising a primary core on one side of the transformer and a secondary core on the other side of the transformer. The cores are magnetically coupled selectively by moving a magnetic ferrite coupler in and out of alignment with the poles of the cores. The direct current from the energy source is converted to a time varying current by an oscillating circuit, which oscillating circuit is optically coupled to a secondary winding on the secondary core to interrupt oscillations upon the voltage in the secondary winding exceeding a preselected level. 4 figs.

57251 **Pressure transducer.** Anderson, T.T.; Roop, C.J.; Schmidt, K.J.; Gunchin, E.R. US Patent Application 6-014,551. 13 Feb 1987. 16p. Contract W-31109-ENG-38. NTIS, PC A03.

A pressure transducer suitable for use in high temperature environments includes two pairs of induction coils, each pair being bifilarly wound together, and each pair of coils connected as opposite arms of a four arm circuit; an electrically conductive target moveably positioned between the coil pairs and connected to a diaphragm such that deflection of the diaphragm causes axial movement of the target and an unbalance in the bridge output. 7 figs.

4209 Waste Processing Plants And Equipment

57252 **(DOE/CE/15298—T1) The Flumeter{trademark}: A new tool for wastewater management.** Hunter, R.M. (Yellowstone Environmental Science, Bozeman, MT (USA)). May 1988. Contract FG01-86CE15298. 134p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88010302/JAW.

Wastewater system managers and engineers are often faced with the problem of measuring flows in closed conduits (e.g., small sewers) that operate both under open channel conditions and under full pipe flow conditions. Solutions to the problem developed previously have had serious limitations. The Flumeter{trademark} technology described in this report has few limitations and shows great promise as a simple and reliable means of measuring such flows.

57253 **Method of processing materials using an inductively coupled plasma.** Hull, D.E.; Bieniewski, T.M. US Patent Application 6-037,898. 13 Apr 1987. 13p. Contract W-7405-ENG-36. NTIS, PC A03/MF A01.

A method of processing materials. The invention enables ultrafine, ultrapure powders to be formed from solid ingots in a gas free environment. A plasma is formed directly from an ingot which insures purity. The vaporized material is expanded through a nozzle and the resultant powder settles on a cold surface. An inductively coupled plasma may also be used to process waste chemicals. Noxious chemicals are directed through a series of plasma tubes, breaking molecular bonds and resulting in relatively harmless atomic constituents. 3 figs.

4210 Combustion Systems

REFER ALSO TO CITATION(S) 56012, 56388, 56526, 56738

57254 **(AD-A—194839/7/XAB) Expert computer program for boiler-water treatment. Master's thesis.** Kaminskas, M.J. (Air Command and Staff Coll., Maxwell AFB, AL (USA)). 1988. 179p. (ACSC—88-1425). NTIS, PC A08/MF A01.

AFR 91-40, Industrial Water Treatment, 24 September 1984, initiated a new era in Air Force boiler-water treatment. The study evaluates the current implementation status of this regulation through associated formal schools support, central laboratory use, check-analysis performance, and AFESC Corrosion Analysis Reports. The evaluation identifies a lack of expertise at base level due to lagging technology transfer. The study then investigates the development of an expert computer program following AFR 91-40 and AFP 91-41, Industrial Water Treatment Procedures, 18 September 1987, to improve this information transfer and bolster management emphasis. Initial validation against Maxwell AFB central energy plant data identifies problem areas confirmed by plant personnel. Using program output, the author recommends a pretreatment system and generic chemicals that have an estimated effective annual savings of $11,505. The study concludes that additional validation of the program is necessary and recommends a one-year test by graduates of AFIT's ENG 595, Industrial Water Treatment, course.

57255 **(NEI-FI—15) Combustion techniques of coal water mixtures in asphalt plant and the reduction of flue gas impurities. Final report of an experimental action project.** Kaksonen, R. (Lemminkaeinen Oy, Helsinki (Finland)). Jan 1987. 72p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754864/JAW.

This experimental action project is a sequel to the research project /sup U/se of solid fuel in asphalt plants/sup ,/ as a result of which combustion equipment for coal-water-mixture was preliminary developed. A renewed burner was modified into a drum-mix asphalt plant. A new preheating unit, automatic control unit and coal-water-tank was constructed for the burner. Testing of this equipment with coal-water-mixture in summer 1986 is reported on this final report. Also some fluegas measurements made 1985 in plants using fuel oil and natural gas are reported. The aim of this research was also to investigate the use of limestone injection for the reduction of fluegas impurities. This part was rejected because fluegas analysis showed that building of sulphurdioxide occurred also in normal drums. In addition to this the possible reduction of sulphur emissions would not have been so remarkable that heavy fuel oil could have been used instead of light fuel oil. Fluegas analysis indicated that the combustion technique of heavy fuel oil is not the best possible in every asphalt plant. This could lead to an increase of total emissions by effecting the combustion efficiency when using limestone injection.

57256 **(PB—88-238357/XAB) Development of sorbent injection criteria for sulfur oxides control from tangentially fired coal boilers. Final report, July 1985-August 1987.** Koucky, R.W.; Marion, J.L.; Anderson, D.K. (Combustion Engineering, Inc., Windsor, CT (USA)). Aug 1988. 334p. NTIS, PC A15/MF A01.

The report describes a program to develop design criteria for injecting dry sorbents into tangentially fired coal furnaces for the control of SOx emissions. The program included aerodynamic cold-flow testing and mathematical modeling of sorbent injection, demonstration testing of SOx emissions control in a 14.7 MW thermal (50 million Btu/hr) tangentially fired Boiler Simulation Facility (BSF), and development of recommendations for sorbent injection in a tangentially fired boiler demonstration of the process. The isothermal flow modeling led to development of sorbent-injection systems for tangentially fired furnaces which provide high levels of sorbent dispersion. A sorbent dispersion mathematical modeling technique was developed to support flow modeling in identifying and optimizing sorbent injection locations and methods. A procedure was developed for specifying sorbent injection locations and methods for a full-scale demonstration of the sorbent injection process in a tangentially fired utility boiler.

57257 **(SVF—305) Combustion of refuse in a fluidized bed. Investigation of the effects of a dolomite addition on sintering and formation of deposits.** Rudling, L. (Studsvik AB, Nykoeping (SE)). (Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden); Studsvik Energiteknik AB, Nykoeping (Sweden)). May 1988. 106p. (In Swedish). (STUDSVIK-EP—87-39). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755116/JAW.

The aim of this investigation has been to examine the effects of a dolomite addition during burning of refuse in a fluidized bed. The influence of sintering in the bed, deposits in the furnace and in the convection part and finally the capture of chloride and sulphur in the bed and the fly ash has been investigated. The experiments were carried out in a 10 MW bubbling fluidized bed. Addition of dolomite in or above the bed reduced the risk for bed sintering considerably. The sintering temperature of the bed was increased from 840 degrees C to 960-1000 degrees C without respectively with dolomite added. The deposits in the furnace were also reduced. A hydrochloric acid reduction of 80-85% was obtained at a Ca/(S+Cl/s) molar ratio of 3. It was also shown that dolomite, size 0.8-3 mm, could be used as bed material instead of sand. The deposits in the convection part, which gave the most shut-downs of the boiler, could however not be reduced by addition of dolomite. The main reason for the formation of deposits in the convection part was an incomplete combustion of aluminium. Analysis of the different ashes fusibility temperature according to the ISO-540 standard method, showed a great discrepancy from sintering temperatures determined manually. (Visual inspection of a sample in a rotating oven.)

57258 **Combined high-pressure photocatalytic reactor—UHV system and sample transfer device.** Moshfegh, A.Z.; Ignatiev, A. (Department of Physics, University of Houston, Houston, Texas 77204-5504). *Review of Scientific Instruments;* **59**: No. 10, 2202-2205(Oct 1988).

The design and construction of a multistage high pressure photocatalytic reactor and sample transfer device with adaptation to a surface analysis chamber are reviewed in detail. The apparatus consists of four components: (i) a small stainless-steel high-pressure photocatalytic reactor with gas handling section, (ii) a gas product detection chamber with quadrupole mass spectrometer (QMS), (iii) an ultrahigh-vacuum (UHV) surface analysis system, and (iv) a bellows-type sample transfer device incorporated with a worm gear. The reactor, which has a total internal volume of ≅320 ml, is capable of operation under dynamic (flow) or static (batch) modes. It includes a sapphire view port to enable the study of the influence of UV-visible photoirradiation on low surface area (≅1 cm^2) metal and metal oxide catalysts in various heterogeneous catalytic reactions. The catalyst sample can undergo any chemical process within the pressure range of from ≅1 x 10^{-9} to 2 x 10^{+3} Torr and over a temperature range of 80—1100 K. The catalyst can be positioned at three different stages for parking and loading, chemical reaction processes, and surface analysis. The sample transfer device has the ability to translate the catalyst under UHV conditions from the parking and loading stage to the surface analysis chamber (a distance of 620 mm). Before and/or after any chemical process, the surface of the catalyst can be characterized by AES, XPS, UPS, ESDIAD, and TDS techniques in the surface analysis system.

57259 **Fluidized bed calciner apparatus.** Owen, T.J.; Klem, M.J. Jr.; Cash, R.J. (to Dept. of Energy, Washington, DC). US Patent 4,755,138. 5 Jul 1988. Filed date 23 Apr 1987. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A fluidized bed calciner is described including a shell, a fluidized bed disposed in the shell, a fluidized bed support member disposed in the shell, the support member in communication with the fluidized bed for supporting the fluidized bed. The support member has substantially rectangularly shaped slots for providing means for uniform fluidization, comprising: (a) parallel first channels traversing the top surface of the support member without interruption from one edge to the other edge thereof; and (b) parallel second channels disposed perpendicularly to the first channels and traversing the bottom surface of the support member without interruption from one edge to the other edge thereof, the first channels and the second channels forming a checkerboard lattice through which the fluidizing gas passes.

4230 Marine Engineering

REFER ALSO TO CITATION(S) 56965, 57176, 57177

57260 (NEI-NO—53) Internalization of Norwegian offshore industry. (Norsk Hydrologisk Komite, Oslo (Norway)). 1985. 162p. (In Norwegian). (CONF-8502160—). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88754873/JAW.

From Internalization of Norwegian offshore industry; Oslo, Norway (12 Feb 1985).

The conference proceedings contain 8 papers. The topics covered are: The internalization of Norwegian industry; The possibilities for deliveries from Norway; The maritime industries' role in a strategy for internalization; The Benin model; How can Norwegian oil companies contribute to an internalization of Norwegian offshore. No separate abstracts of the papers were prepared.

57261 (RF/SPT/T—8/87) Mechanized drilling equipment and personal injuries. Price, M. (Rogalandsforskning, Stavanger (Norway)). Nov 1987. 62p. (In Norwegian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754878/JAW.

The present report embodies the results and conclusions from an analysis of the personal injuries caused by the use of new types of mechanized drilling equipment on the Norwegian continental shelf in the period from 1980 to 1986. The report aims at the identification of the most commom types of injuries and causal relations, and evaluates the use and functionality of the equipment. 13 drawings, 24 tables.

57262 (RISO-M—2714) Fatigue testing. Establishment of a standard method for fatigue testing under variable load amplitudes simulating offshore load spectra. Broendsted, P. (Risoe National Lab. (DK); Slind, T.(SINTEF Division 18, Trondheim (NO)); Solin, J. (VTT, Metals Laboratory, Espoo (FI)).). (Risoe National Lab., Roskilde (Denmark)). May 1988. 78p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88754883/JAW.

The results of an Internordic co-operative project are described. A standard spectrum for fatigue testing is proposed. It simulates the long term wave action history to inertia dominated structures in the North-Sea. Testing facilities for crack growth testing using the proposed spectrum have been developed and used in comparative tests. The results are realistic and reproduceable in all the three participating laboratories. The spectrum test results were well comparable to the constant amplitude test results at high nablaK values, but the results indicate that lower crack growth thresholds can be obtained by spectrum loading in air. 4 tabs., 56 ills., 11 refs.

57263 (STF—75A87027) Crisis intervention in offshore production: Survey of human and organizational factors. Sten, T.; Ulleberg, T. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Mar 1988. 60p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88754912/JAW.

This report provides a summary and discussion of human and organizational factors important to crisis intervention from VDU-based control centres. It is based on a survey of existing research, considered most relevant to the problem areas in question. Additionally, a brief survey is undertaken of design requirements and philosophies with regard to offshore supervisory and process control systems. Together with experiences from field studies, this report will provide background data for a summary report giving results and recommendations. 4 drawings, 1 table.

57264 (STF—75A87040) SCSSV reliability tested in North Sea. Molnes, E.; Rausand, M.; Lindquist, B. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Dec 1987. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88754913/JAW.

The report covers composite performance data for a variety of Surface Controlled Subsurface Safety Valves (SCSSV's) from a total of 26 different oil and gas fields in the North Sea Basin. An extract of the statistical treatment of performance data is given. Additionally, major conclusions from the study upon which the article is based, are quoted. 2 drawings, 4 tables.

57265 (STF—75A87043) Crisis intervention in offshore production. Summary of problem areas. Bodsberg, L.; Ingstad, O.; Sten, T.; Ulleberg, T. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Feb 1988. 106p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88754914/JAW.

The report summarizes the results of the first phase of the CRIOP project (Crisis Intervention in Offshore Production), where the goal has been to identify problem areas within the subject crisis intervention from VDU-based control centres. Problem areas are stated as hypotheses, and preliminary conclusions are given. The summary report is based on the following CRIOP activities: Literature survey of human and organizational factors; study of Norwegian Petroleum Directorate data; field study of a land-based control room; field study of an offshore control room; seminar on handling of crisis situation. 1 drawing, 2 tables, 29 references.

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 56015, 56527

57266 (NEI-DK—96) Flue gas desulfurization by a semi-dry method. Touborg, J. (Smidth (F.L.), Copenhagen (Denmark)). Mar 1988. 23p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754863/JAW.

During the summer of 1984 the Ministry of Energy approved a project from FLS under its "Energy research programme 84" with the title "Desulphurization of flue gas by a semi-dry method". The FLS desulphurization equipment is based upon application of the FLS suspension reactor, in which the flue gas is mixed with a suspension of atomized lime sludge which is dried during the process. In a succeding cyclone the flue gas now desulphurized is separated from the lime dust, part of which is returned to the suspension reactor. The process has the effect that absorption of sulphur becomes very intense and efficient, and that the absorbent agent is recirculated to a much greater extent compared to the semi-dry technique previously known. By this process even flue gas with a high content of sulphur-dioxide can be cleaned in an economically acceptable way. During 1985 and 86 a total of three test periods were run. This report is based on data from the third test period in the autumn of 1986. The test confirmed the assumption that FLS's process for removal of SO/sub 2/ from flue gas from power stations is better or at least as good as other semi-dry processes on the market. The experience gained from the tests do, however, suggest that the next generation of plants will differ somewhat from the pilot plant. (EG).

57267 (PB—88-234190/XAB) Cost of controlling directly emitted acidic emissions from major industrial sources. Final report, February 1985-August 1986. Emmel, T.E.; Waddell, J.T.; Adams, R.C. (Radian Corp., Research Triangle Park, NC (USA)). Jul 1988. 169p. (DCN—86-203-023-13-18). NTIS, PC A08/MF A01.

This report gives results of estimates, using a model-plant approach, of costs for retrofitting selected acidic-emission-control systems to utility and industrial boilers, Claus sulfur-recovery plants, catalytic-cracking units, primary copper smelters, coke-oven plants, primary aluminum smelters, and municipal solid-waste incinerators. Cost-effectiveness (defined as the unit annual cost for removing acidic materials) of each control system was calculated based on the anticipated performance of the system. If SO_2 is simultaneously emitted with the acidic materials, controls were selected that removed both SO_2 and the acidic materials. Cost-effectiveness was considerably better for the combined (SO_2 plus acidic material) removal systems. Because of a need for performance data on acidic-emissions-control systems, it would be desirable if research could be conducted on removing acid sulfates and nitrates by existing gaseous and particulate control systems.

4250 Power Cycles

57268 (CONF-881105—2) Stirling engines and irrigation pumping. West, C.D. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01. Order Number DE88016359/JAW.

From 4. international conference on stirling engines; Tokyo, Japan (7 Nov 1988).

A brief outline is given of the performance that might be achievable from various kinds of Stirling engine driven irrigation pumps. Some emphasis is placed on the very simple liquid piston engines, suitable for low technology manufacture, that have been the recent subject of research. 5 refs., 3 figs., 3 tabs.

57269 (DOE/NASA/0372—1) Conceptual design of an Advanced Stirling Conversion System for terrestrial power generation. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center; Mechanical Technology, Inc., Latham, NY (USA); Sanders Associates, Inc., Nashua, NH (USA); Thermacore, Inc., Lancaster, PA (USA); Pioneer Engineering and Mfg. Co., Madison Heights, MI (USA)). Jan 1988. Contract AT04-85AL33408. 386p. (NASA/CR—180890; MTI—87TR57). NTIS, PC A17. Order Number DE89001471/JAW.

This report describes the conceptual design of a system for converting solar energy into electricity using a free-piston Stirling engine directly coupled to a linear alternator. The system is designed for mounting at the focal plane of a 100 m^2 parabolic solar collector. It includes a receiver which is integrated with the engine heater head. Heat transfer from receiver to engine involves boiling liquid sodium at the heater surface of the receiver and condensing sodium vapor on the engine heater tubes. A sintered wick is located on the back surface of the receiver face to distribute the sodium and gravity is used to return the condensed sodium to a sump within the receiver. The system is connected to a utility power grid. The net power output from the system is 23.2 kWe at the design point (75 kWt into the receiver). Maximum power output is 26.7 kWe at the peak insolation level. Annual output is approximately 60,000 kWh for a site at Albuquerque, New Mexico. The manufacturing cost for the System has been estimated at approximately $8500 (1984 dollars). The installed cost goal is $13,000 (1984 dollars). Costs at the conceptual design level are only approximate but the estimates indicate that acceptable costs are attainable. 2 refs.

43 PARTICLE ACCELERATORS

57270 (CONF-8806167—3) The Argonne Fragment Mass Analyzer. Davids, C.N.; Larson, J.D. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01. Order Number DE89000588/JAW.

From Symposium on heavy ion interactions around the Coulomb Barrier; Padova, Italy (1 Jun 1988).

The Fragment Mass Analyzer is being constructed for use in heavy-ion experiments with the ATLAS superconducting linear accelerator system at Argonne National Laboratory. It is a triple-focussing recoil mass spectrometer, designed to separate nuclear reaction recoils from the primary heavy-ion beam and disperse them in M/Q (mass/unit charge) at the focal plane. The main ion-optical elements are two electric dipoles and a magnetic dipole, with the electric dipoles (E) symmetrically placed before and after the magnet (M). The elements are spaced such that the position energy dispersion (x/δ/sub E/) and the angle energy dispersion (θ/δ/sub E/) of the system both vanish (energy focus). Here δ/sub E/ stands for ΔE/E, the fractional energy deviation from the central energy. The energy-dispersionless EME configuration was first used by Cormier and Stwertka for the Recoil Mass Spectrometers at Rochester, and was also chosen by Spolaore et al. for the Recoil Mass Spectrometer at the Laboratori Nazionali di Legnaro in Padua. Although the energy dispersion is canceled, the M/Q dispersion is not, and the device performs as a mass spectrometer. When used in the energy-dispersionless mode, the EME combination of elements offers some distinct advantages over designs containing Wien filters or a single electrostatic element. These advantages include wider M/Q and energy acceptances and superior rejection of the primary beam ({approximately}10/sup {minus}12/). The energy focus condition implies isochronous orbits for particles having the same M/Q and energy but with differing emission angles at the target, an important feature when used with pulsed beam accelerators like ATLAS. 8 refs., 4 figs., 1 tab.

57271 (PB—88-229414/XAB) Geological-geotechnical studies for siting the Superconducting Super Collider in Illinois: results of drilling large-diameter holes in 1986. Environmental geology notes. Vaiden, R.C.; Hasek, M.J.; Gendron, C.R.; Curry, B.B.; Graese, A.M. (Illinois State Geological Survey, Champaign (USA)). 1988. 65p. (IL/SGS/ENG—124). NTIS, PC A04/MF A01.

See also PB—88-229422.

The Illinois State Geological Survey (ISGS) has completed an extensive four-year exploration of the area near Fermi National Accelerator Laboratory (Fermilab) at Batavia, 30 miles west of Chicago. The comprehensive investigation was conducted to locate the most suitable site for construction and operation of the Superconducting Super Collider (SSC) - a 20-trillion electron volt (TeV) subatomic particle accelerator. Underlying the proposed site in northeastern Illinois, between 250 and 600 feet deep, are the Galena and Platteville dolomites - strong, stable, nearly impermeable bedrock. To confirm that these bedrock units are suitable for construction of the SSC, ISGS geologists designed a four-year study including test drilling, rock sampling and analysis, geophysical logging, hydrogeologic studies, and seismic exploration. Initially, the study covered parts of six counties. Subsequent research focused on successively smaller areas until the final stage of test drilling in spring 1986 concentrated on a proposed corridor for the SSC tunnel. From 1984 to 1986, thirty 3-inch-diameter test holes were drilled and more than 2 miles of bedrock core was recovered for stratigraphic description and geotechnical analysis.

57272 (PB—88-229422/XAB) Geological-geotechnical studies for siting the Superconducting Super Collider in Illinois: results of the 1986 test drilling program. Environmental geology notes. Curry, B.B.; Graese, A.M.; Hasek, M.J.; Vaiden, R.C.; Bauer, R.A. (Illinois State Geological Survey, Champaign (USA)). 1988. 127p. (IL/SGS/EGN—122). NTIS, PC A07/MF A01.

See also PB—87-187159 and PB—88-229414.

From 1984 through 1986, geologists from the Illinois State Geological Survey (ISGS) conducted a thorough field investigation in northeastern Illinois to determine whether the surface and subsurface geology would be suitable for constructing the U.S. Department of Energy's 20-TeV (trillion electron volt) particle accelerator - the Superconducting Super Collider (SSC). The third and final stage of test drilling in 1986 concentrated on a specific corridor proposed for the racetrack-shaped SSC that would circle deep below the surface of Kane, Kendall, and Du Page Counties. The main objective was to verify that bedrock lying under the region satisified the site criteria for construction of a 10-foot-diameter tunnel to hold the particle accelerator and the superconducting magnets, large chambers to house the laboratories and computers for conducting and recording experiments, and shafts to provide access to the subterranean facilities. Thirteen test holes, ISGS S-18 through S-30, were drilled to depths ranging from 398.2 to 646.6 feet. The field team recovered 5675 feet of bedrock core and 212 samples of glacial drift (sand, clay, gravel) for laboratory analyses and recorded on-site data that establish the thickness, distribution, lithology (composition), and other properties of the rocks lying under the study area.

57273 (RAL—88-059) Experimental high energy physics and modern computer architectures. Hoek, J. (Rutherford Appleton Lab., Chilton (UK)). Jun 1988. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755242/JAW.

The paper examines how experimental High Energy Physics can use modern computer architectures efficiently. In this connection parallel and vector architectures are investigated, and the types available at the moment for general use are discussed. A separate section briefly describes some architectures that are either a combination of both, or exemplify other architectures. In an appendix

some directions in which computing seems to be developing in the USA are mentioned.

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 57208

57274 **(BNL—41592) Model measurements for new accelerating techniques.** Aronson, S.; Haseroth, H.; Knott, J.; Willis, W. (Brookhaven National Lab., Upton, NY (USA); European Organization for Nuclear Research, Geneva (Switzerland)). Jun 1988. Contract AC02-76CH00016. 8p. (CONF-8803146—1). NTIS, PC A02. Order Number DE88016735/JAW.

From Workshop on pulse power techniques; Erice, Italy (5 Mar 1988).

We summarize the work carried out for the past two years, concerning some different ways for achieving high-field gradients, particularly in view of future linear lepton colliders. These studies and measurements on low power models concern the switched power principle and multifrequency excitation of resonant cavities. 15 refs., 12 figs.

57275 **(BNL—41692) The Brookhaven Radiation Effects Facility.** Grand, P.; Snead, C.L.; Ward, T. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 10p. (BNL/NPB—88-91; CONF-8810166—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88017335/JAW.

From 11. aerospace testing seminar; Manhattan Beach, CA, USA (11 Oct 1988).

The Neutral Particle Beam (NPB) Radiation Effects Facility (REF), funded by the Strategic Defense Initiative Office (SDIO) through the Defense Nuclear Agency (DNA) and the Air Force Weapons Laboratory (AFWL), has been constructed at Brookhaven National Laboratory (BNL). Operation started in October 1986. The facility is capable of delivering pulsed H^-, H/sup o/, and H^+ beams of 100 to 200 MeV energy up to 30 mA peak current. Pulses can be adjusted from 5 μs to 500 μs length at a repetition rate of 5 pps. The beam spot on target is adjustable from 3 to 100 cm diameter (2 σ) resulting in a maximum dose of about 10 MRads (Si) per pulse (small beam spot). Experimental use of the REF is being primarily supported by the SDI lethality (LTH-4) program. The program has addressed ionization effects in electronics, both dose rate and total dose dependence, radiation-sensitive components, and dE/dx effects in energetic materials including propellants and high explosives (HE). This paper describes the facility, its capabilities and potential, and the experiments that have been carried out to date or are being planned. 2 refs., 10 figs.

57276 **(BNL—41766) Design and modelling of a 5 MeV radio frequency electron gun.** Batchelor, K.; Sheehan, J.; Woodle, M. (Brookhaven National Lab., Upton, NY (USA)). 22 Aug 1988. Contract AC02-76CH00016. 24p. NTIS, PC A03/MF A01. Order Number DE89001588/JAW.

The Accelerator Test Facility (ATF) at Brookhaven National Laboratory is a linac-laser complex for research into laser acceleration and for the generation of coherent radiation from electron beams. In order to achieve the design 50 MeV output emittance ($y\sigma$/sub x/σ/sub x/') of less than 3 {times} 10/sup {minus}5/ m rad a high brightness electron gun is required. This paper describes computations and measurements made on a full scale brass model of a 1-1/2 cell, π-mode, resonant, disc loaded, radiofrequency gun structure which has been designed for this purpose. 7 refs., 9 figs., 6 tabs.

57277 **(FNAL-TM—1536) The Fermilab upgrade.** Lederman, L.M. (Fermi National Accelerator Lab., Batavia, IL (USA)). 25 Sep 1988. Contract AC02-76CH03000. 18p. (CONF-8806243—2). NTIS, PC A03/MF A01. Order Number DE89001279/JAW.

From DPF summer study: Snowmass '88 on high energy physics in the 1990s; Snowmass, CO, USA (27 Jun 1988).

This paper discusses the upgrades needed at Fermilab Tevatron facility to meet the future physics needs. Historical aspects are also discussed. 3 figs.

57278 **(INIS-mf—11263, pp 167-190) Hard gamma radiation source for gamma activation analysis.** Vognar, M. (Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia). Fakulta Jaderna a Fysikalne Inzenyrska). 1987. (In Czech). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88704145/JAW. (CONF-8710342—).

From Mining Pribram in science and technology; Pribram, Czechoslovakia (12 Oct 1987).

A detailed description is presented of Czechoslovak microtron MT 22 which was built at the Faculty of Nuclear Physics and Engineering of the Czech Technical University in Prague and put into operation in 1981. The microtron generates accelerated electron beams of an energy of up to 22 MeV and a rated mean current of 2x10/sup -5/A. The monoenergetic nature of the electrons is better than 1%. The MT 22 microtron was used for the determination of gold in geological samples using microtron gamma activation analysis. Roughly ground samples of mineral materials (grain size below 2 mm) were used for the analysis. Nuclear reaction (γ,γ') was used for the determination and the activity of irradiated samples was measured using the /sup 197m/Au isomer. A 4000-channel Canberra spectrometer was used in the measurement. The limit of gold determinability in real samples ranges from 0.5 ppm to 2 ppm. The method is not suitable for the determination of trace elements in heavy minerals concentrates or for ores with U and Th concentrations of more than 30 ppm. (E.S.). 10 refs., 3 tabs., 4 figs.

57279 **(INIS-SU—45, pp 54-56) H/sup -/ ion production in a diode with magnetic insulation during dielectric breakdown initiation by laser pulse.** Papadichev, V.A.; Pikuz, S.A.; Shelkovenko, T.A. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780096/JAW.

Kratkie Soobshcheniya po Fizike.; (no.11).

In Plasma physics. Collection.

A new flowsheet of negative ion (H/sup -/) pulse kiloampere current production in a diode with magnetic insulation, when initiating dielectric surface breakdown by laser radiation, is suggested. Experiments on H/sup -/ production were carried out using the "Impulse" accelerator with voltage pulse of 500-800 kV and current of 30 kA. Neodymium glass laser with pulse duration of 30 ns, laser radiation flux density of 10/sup 9/ W/cm/sup 2/, was used. H/sup -/ yield equal to 10/sup 14/ particles per impulse was detected. The results obtained showed the efficiency of the method suggested and its applicability for ion gun development. 6 refs.; 2 figs.

57280 **(JINR—9-87-840) Forming and study of narrow proton beams at 660 MeV for radiation therapy.** Zorin, V.P.; Kutuzov, S.A.; Mirokhin, I.V.; Mitsyn, G.V.; Molokanov, A.G.; Savchenko, O.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1987. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704376/JAW.

A channel for forming and transport of narrow proton beams 5-10 mm in diameter in a box No.3 of clinical-physical complex of LNP, JINR is described. Main parameters of these beams, beam scattering in air and water are studied. A principal possibility of using these beams for radiation therapy of targets inside skull by "piercing" irradiation method is shown. 6 refs.; 4 figs.

57281 **(JINR-D—1,2-86-668, pp 324-333) From a synchrophasotron to a nuclotron.** Kovalenko, A.D. 1987. (In Russian). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88780187/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

The development history of JINR synchrotron put into service in 1957 is described. In 1970 deuteron acceleration up to 8.9 GeV energy was received on the accelerator. With promotion to the region of heavier nuclei arose the task to reconstruct synchrotron into nucletron. The main projected parameters of nucletron, which represents a hard-focusing superconducting synchrotron

with divided functions of turning and focusing, are given. The accelerator perimeter is 54 m. Finite proton energy constitutes 1500 MeV, nuclei energy - 526 MeV/nucleon, and heavy non-realistic ions energy - 2700 (Z/A)/sup 2/. Now on the constructed accelerator setup and maintenance is conducted, stable beam circulation during 100 ms is received. There are conducted tunnel preparations for deployment of nucletron magnetic system. 19 refs.; 2 figs.; 2 tabs.

57282 **(LA-UR—88-3042) BEAR RFQ: Beam Experiment Aboard a Rocket.** Schrage, D.; Young, L.M.; Campbell, B.M.; Billen, J.H.; Stovall, J.; Martinez, F.A.; Clark, W.L.; Gibbs, W.S.; King, J.D.; O'Shea, P.G. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 14p. (CONF-881151—8). NTIS, PC A03/MF A01. Order Number TI89000331/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

Los Alamos National Laboratory, Grumman, and GAR Electroformers have completed the design and fabrication of an electroformed RFQ for the BEAR (Beam Experiments Aboard a Rocket) project. The design of this 1-m-long, lightweight (<55 kg) accelerator incorporates four aluminum vane/cavity quadrants joined by an electroforming process. With the vane and cavity fabricated as a monolithic structure, there are no mechanical rf, vacuum, or structural joints. The completed BEAR RFQ has successfully passed flight qualification and beam transport tests in preparation for the flight, which is scheduled for March 1989. 12 refs., 5 figs., 1 tab.

57283 **(LA-UR—88-3258) Design and construction of the photocathode electron gun cavity.** Gray, E.R.; Fraser, J.S. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 4p. (CONF-881049—18). NTIS, PC A02/MF A01. Order Number DE89000339/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

A 1300-MHz, two-cell rf accelerator cavity has been constructed for the high-brightness photocathode electron source program. Each cell has an rf drive. Cell one has a replacement photocathode plug on the back wall and has a shape designed for linear radial fields. Cell two has a more standard high-shunt-impedance shape. SUPERFISH values for shunt impedances are, respectively, 29.5 and 45.8 M{Omega}/m. Peak surface field maximums are 58.9 and 32.1 MV/m for an electron acceleration of 0.9 and 1.0 MeV. Drive coupling is matched for 55 and 86% beam loading at 1-A average current. The system has vacuum pumping ports, into both cells and is baked at 300{degree}C. Typical operating pressures are in low 10{sup {minus{10}}-torr range. Cell frequencies are fine tuned by a combination of operating temperature and cell nose pulling. Cell-to-cell coupling was intended to be low (K = 0.0002); however, because of the high Qs (13,300 and 20,000), substantial coupling effects are seen. Cutting the vacuum-port slots shifted the frequencies by 1.5 MHz and gave an apparent 10% increase in the cavity Qs. Construction of the cavity required a series of four brazes with several annealing cycles. All joints are flat, and the sequence is such that each joint is brazed horizontally; as a result, all joints were successfully brazed on the first attempt. The latest experiment measurements are given in another paper at this conference. 2 refs., 3 figs.

57284 **(LA-UR—88-3262) Field stability in two-stem drift-tube linacs.** Billen, J.H.; Spalek, G.; Shapiro, A.H. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 3p. (CONF-881049—26). NTIS, PC A02/MF A01. Order Number DE89000334/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

Drift tubes supported by two stems have been considered for cryogenic drift-tube linacs (DTLs) to reduce vibrations and to minimize drift-tube deflections upon cool down. We investigated rf properties of two-stem DTL structures at room temperature and low power. Even apart is inherently more stable against tuning errors than a similar structure with single stems. The increased stability is higher for DTLs with shorter drift tubes. Ordinary quarter-wavelength-long post couplers actually destabilize the two-stem DTL fields; the extra stem raises the post coupler frequency compared to the frequency of the same post coupler extended beyond the tank wall into coaxial stub tuners. Adjustment of the stub lengths tunes the post-coupler frequencies, but post-coupler lengths in the tank have no effect, which suggests a field pattern different from traditional post couplers. The stabilized DTL resembles multiple-stem DTLs in which the angle between stems is varied to achieve stabilization. Adjusting the coaxial stub length is mechanically simpler than changing the stem azimuth angle. 5 refs., 6 figs., 1 tab.

57285 **(LA-UR—88-3264) Post-coupler stabilization and tuning of a ramped-gradient drift-tube linac.** Billen, J.H.; Shapiro, A.H. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 4p. (CONF-881049—3). NTIS, PC A02/MF A01. Order Number DE89000309/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

This paper reports low-power tuning and stabilization measurements on the Los Alamos Ramped-Gradient Drift-Tube Linac (RGDTL). The RGDTL is a 425-MHz, 1.87-m-long structure containing 29 drift tubes, 14 post couplers, 2 tuners, and 2 drive loops. The design calls for an axial electric field gradient that increases from 2.0 MV/m to 4.4 MV/m over 1.5 m for accelerating H/sup {minus}/ from 2.07 to 6.67 MeV. Asymmetric post couplers adjacent to every other drift tube both stabilize and ramp the field. The two tuners provide 1.4 MHz of dynamic frequency adjustment around the frequency selected by a one-time trimming of two tuning bars that are bolted inside the tank alongside the drift-tube stems. Field measurements obtained by the bead-perturbation method determine how to adjust the post couplers for the desired ramp. Comparison of two field distributions for different deliberate frequency perturbations quantifies the structure's tilt sensitivity and indicates whether to tune the post coupler frequencies lower or higher with respect to the TM_{010} accelerating mode frequency. 3 refs., 6 figs., 1 tab.

57286 **(LBL—25234) Performance of MBE-4: An experimental multiple beam induction linear accelerator for heavy ions.** Warwick, A.I.; Fessenden, T.J.; Keefe, D.; Kim, C.H.; Meuth, H. (Lawrence Berkeley Lab., CA (USA)). Jun 1988. Contract AC03-76SF00098. 4p. (CONF-880695—66). NTIS, PC A02/MF A01. Order Number DE89001319/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

An experimental induction linac, called MBE-4, has been constructed to demonstrate acceleration and current amplification of multiple heavy ion beams. This work is part of a program to study the use of such an accelerator as a driver for heavy ion inertial fusion. MBE-4 is 16m long and accelerates four space-charge-dominated beams of singly-charged cesium ions, in this case from 200 keV to 700 keV, amplifying the current in each beam from 10mA by a factor of nine. Construction of the experiment was completed late in 1987 and we present the results of detailed measurements of the longitudinal beam dynamics. Of particular interest is the contribution of acceleration errors to the growth of current fluctuations and to the longitudinal emittance. The effectiveness of the longitudinal focusing, accomplished by means of the controlled time dependence of the accelerating fields, is also discussed. 4 refs., 5 figs., 1 tab.

57287 **(LBL—25368) Design and fabrication of 33 GHz high-gradient accelerator sections.** Hopkins, D.B.; Sessler, A.M.; Johnsen, H.A.; Farmer, J.C.; Kelley, W.K.; Steffani, C.P.; Haimson, J.; Mecklenburg, B. (Lawrence Berkeley Lab., CA (USA)). Jun 1988. Contract AC03-76SF00098. 13p. (CONF-880695—63). NTIS, PC A03/MF A01. Order Number DE89000483/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

As part of a two-beam accelerator research program {similar←to}33 GHz accelerator sections have been designed and fabricated by both the machined-and-brazed technique and the electroforming technique. These procedures are summarized in this paper. Special requirements included a filling time of about 14 ns, +- 1.25 μm dimensional tolerances, input VSWR ≦1.10, radial vacuum pumping for each cell, and a capability for a 200--300 MV/

m accelerating gradient. A 34-cavity, 2π/3 mode, quasi-constant gradient, v/sub p/ = c, {similar←to}10 cm-long, disc-loaded waveguide structure design and chosen with optimized sidewall input/output iris couplers. 13 refs., 5 figs., 1 tab.

57288 (SAND—88-2314C) A 20 MHz ferrite inductive isolation loss study. Lancaster, K.T.; Buttram, M.T. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 15p. (CONF-881049—23). NTIS, PC A03/MF A01. Order Number DE89001180/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

This paper presents data on ferrite core samples that were tested with an applied 20 kilovolt, 25 ns unipolar pulse. The intent of this study was to identify ferrite materials that had superior blocking characteristics at this frequency. The 15 samples are toroidal cores with a 7.6 cm outside diameter, a 3.8 cm inside diameter and a 1.27 cm thickness. The sample cores acted as blocking inductors in the test circuit. When pulsed, the excitation current and induced voltage were recorded and presented in graphical form. The principal data evaluated in this study were power loss and maximum delta B swing. Four samples wee tested from Phillips Corp. (Holland): 4M2, 4L2, 8C11, and 8C12. Five samples were tested from DK Corp. (Japan): PE11B, PE11BB, PE14, Q5B, and MD9. Six samples were tested from Ceramic Magnetics Corp. (USA): CMD5005, CN20, C2003, C2010, C2025 and C2050. The results of this study identify four materials that have pulsed relative permeability (>400) and a total magnetic induction swing (ΔB) greater than 0.6 Tesla at this frequency. 2 refs., 11 figs., 1 tab.

57289 (SAND—88-2332C) RADLAC-II accelerator pulsed-power experiments. Smith, D.L.; Shope, S.L.; Hasti, D.E. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 5p. (CONF-8809149—9). NTIS, PC A02/MF A01. Order Number DE89001232/JAW.

From DARPA/SDIO services annual propagation review; Newport, RI, USA (12 Sep 1988).

The final stage of the RADLAC-II linear induction accelerator upgrade is near completion. The upgrade includes improvements in the electron beam energy, current, beam quality, and accelerator reliability. The design goals of 20-MeV (2.5 MV/stage) total beam energy, 40-kA peak current, >40-ns pulse width, >20-ns flattop and a 1-cm radius annular beam have been met by interim configuration tests as predicted by circuit simulations. A description of the new accelerator and a comparison of pulsed-power experimental results with circuit model waveforms are summarized. 11 refs., 4 figs.

57290 (SAND—88-2556C) RADLAC-II upgrade experiments. Shope, S.L.; Frost, C.A.; Hasti, D.E.; Leifeste, G.T.; Mazarakis, M.G.; Poukey, J.W.; Smith, D.L. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 9p. (CONF-8809149—8). NTIS, PC A02/MF A01. Order Number DE89001233/JAW.

From DARPA/SDIO services annual propagation review; Newport, RI, USA (12 Sep 1988).

The linear induction accelerator, RADLAC II, is being upgraded to produce a 20-MeV, 40-kA annular beam. Previously, the accelerator produced a 15-MeV, 15-kA beam. Improvements in the pulsed power, injector design, and magnetic field have resulted in a faster rising, flat-topped voltage pulse. The first experiments used only the injector and produced a 5.3-MeV, 47-kA high quality annular beam that was transported in a 20-kG magnetic guide field to the location of the first 2.5-MV accelerating gap. The beam is now being transported and accelerated through two of the six accelerating gaps. The accelerating gaps are of a unique design that minimizes changes in the radial electric field to reduce the amplitude of radial oscillations. The quality of the accelerated beam will be measured through two gaps before adding the remainder of the accelerator. The upgraded beam will allow high current conditioning, lead pulse stability, and current scaling experiments to be completed. 8 refs., 3 figs.

57291 (SAND—88-2659C) Photoconductive semiconductor switch (PCSS) driven linear induction accelerator (LIA) cavity. Zutavern, F.J.; Loubriel, G.M.; Hamil, R.A.; O'Malley, M.W.; McKenzie, B.B.; Schanwald, L.P. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 5p. (CONF-8809149—4). NTIS, PC A02/MF A01. Order Number DE89001044/JAW.

From DARPA/SDIO services annual propagation review; Newport, RI, USA (12 Sep 1988).

This poster describes experiments to test the concept of actively driving a 20-40 MHz linear induction accelerator with a pulsed power system using photoconductive semiconductor switches (PCSS). An rf-modulated regenerative laser is used to trigger GaAs switches which connect a constant current source to a pair of linear induction cavities. The switches must stand off 500 kV and interrupt 2.5 - 5 kA. Multiple pulse and single pulse test results with one switch driving one cavity are shown. 11 figs.

4302 Beam Dynamics, Field Calculations, And Ion Optics

REFER ALSO TO CITATION(S) 58133, 58264

57292 (CERN—88-04) Second Advanced ICFA beam dynamics workshop on aperture-related limitations of the performance and beam lifetime in storage rings: Proceedings. Hagel, J.; Keil, E. (eds.). (European Organization for Nuclear Research, Geneva (Switzerland)). 29 Jul 1988. 238p. (CONF-8804111—). CERN, European Organization for Nuclear Research, CH-1211 Geneva, Switzerland. Order Number TI88016025/JAW.

From 2. International Committee for Future Accelerators advanced beam dynamics workshop; Lugano, Switzerland (11 Apr 1988).

These proceedings contain the papers presented at the 'Second Advanced Beam Dynamics Workshop on Aperture-Related Limitations of the Performance and Beam Lifetime in Storage Rings,' which was organized in Lugano, Switzerland, from 11 to 16 April 1988, by the Beam Dynamics Panel of the International Committee for Future Accelerators (ICFA). The papers cover experiments on existing accelerators, analytical methods for determining amplitude limitations, criteria for the properties of the circulating beam and for the quality of accelerator components, and compensation schemes for field defects.

57293 (DOE/ER/40136—T8) Electron acceleration by laser fields in a gas: Technical progress report. Fontana, J.R. (California Univ., Santa Barbara (USA). Dept. of Electrical and Computer Engineering). 1 Oct 1988. Contract AS03-84ER40136. 11p. NTIS, PC A03/MF A01. Order Number DE89000567/JAW.

As specified in the proposal, part of the work concerned planning for the experimental tests that will become possible at the completion of the Accelerator Test Facility (ATF) now under construction at the Brookhaven National Laboratory (BNL), and the coordination of research with Spectra Technology, Inc. (STI) in Seattle. This activity is summarized here. In addition, work has proceeded on the theory of Inverse Cherenkov Acceleration by an analysis of how effective currently available lasers can be for acceleration; this also is discussed in this report.

57294 (DOE/ET/53088—340) Overfocusing in a migma and Exyder configuration. Berk, H.L.; Wong, H.V. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Sep 1988. Contract FG05-80ET53088. 22p. (IFSR—340). NTIS, PC A03/MF A01. Order Number DE89000019/JAW.

The theory of overfocusing is developed for a self-colliding storage ring (Exyder) and for a classical migma configuration. Forces due to external and self-generated magnetic fields are considered. The band of energy containment is calculated for a model external magnetic field configuration. The forces due to self-generated magnetic fields are in migma and Exyder can also cause overfocusing, which sets a beta limit on a migma disc and a luminosity

limit on Exyder. The luminosity can increase substantially if the self-colliding storage ring is partially unneutralized. 5 refs., 3 figs.

57295 **(EFI—964(14)-87) Emission from a charged particle oscillating along the direction of motion through a waveguide.** Barsukov, K.A.; Ryazantseva, N.V.; Begloyan, Eh.A.; Laziev, Eh.M. (Leningradskij Ehlektrotekhnicheskij Inst. (USSR); Erevanskij Fizicheskij Inst. (USSR)). (Erevanskij Fizicheskij Inst. (USSR)). 1987. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704319/JAW.

The emission of a charged particle, moving by harmonic law in a waveguide is studied. The expressions for the radiation fields and energy are obtained for the case of finite number os oscillations. The radiation spectrum is analyzed. 3 refs.

57296 **(EFI—981(31)-87) Possibilities for linear waveguide accelerator efficiency increase.** Azizbekyan, G.V. (Erevanskij Fizicheskij Inst. (USSR)). 1987. 12p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704323/JAW.

Problems connected with increasing the efficiency of an intense electron beam interaction with the accelerating electromagnetic field in linear waveguide accelerators are considered. Here the expression for the accelerating electromagnetic field is written as the sum of fields of the generator and the radiation, obtained in the most general case with regard to the slip between the particle clusters and the wave of the radiation field. Comparison between the obtained theoretical values and experimental data for some operating accelerators allows us to conclude on the possibility for designating the more efficient accelerators. It is shown that the limiting values of current in accelerators with exponential dependence of conductivity along a section can be higher than in those with constant or linear dependence. 4 refs.

57297 (INIS-SU—42, pp 31-32) **Critical energy and synchrotron oscillation damping in a compact racetrack.** Moroz, E.M.; Shorin, K.N. 1987. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89780009/JAW.

Kratkie Soobshcheniya po Fizike.; (no.8).
In Experimental and theoretical physics. Collection.

Measures on elemination of destabilizing effect of synchrotron radiation quantum fluctuations on phase motion of electrons in racetrack type synchrotrons with superconducxting magnets are considered. It is shown that under conditions of alternation of the field index values absence of critical energy and availability of radiation damping of electron synchrotron oscillations with high length of linear intervals are simultaneously provided for in magnetic sectors. 1 ref.

57298 (INIS-SU—42, pp 42-44) **To the theory of slipping-instability of non-magnetized electron flux.** Kikvidze, R.R.; Rukhadze, A.A. (AN SSSR, Moscow. Inst. Obshchej Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89780009/JAW.

Kratkie Soobshcheniya po Fizike.; (no.8).
In Experimental and theoretical physics. Collection.

Stability of plane nonrelativistic flux of electrons with nonhomogeneous rate profile with respect to potential perturbations is analysed. Oscillation instability region by longitudinal wave numbers and their maximal increase increment are determined. Possible manifestation of this instability in a tubular relativistic electron beam moving along external magnetic field in cylindrical drift space is discussed. 4 refs.; 1 fig.

57299 (INIS-SU—42, pp 29-30) **To the nonlinear theory of the two-beam instability.** Ignatov, A.M. 1987. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89780009/JAW.

Kratkie Soobshcheniya po Fizike.; (no.8).
In Experimental and theoretical physics. Collection.

Instability of two counter-running plasma fluxes in weak bond is considered. Soliton solution for unstable bending waves is given. 1 ref.

57300 (INIS-SU—44/A, pp 43-45) **Numerical calculation of the coherence factor of microtron beam.** Levonyan, S.V.; Serov, A.V. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780010/JAW.

Kratkie Soobshcheniya po Fizike.; (no.10).
In Experimental and theoretical physics. Collection.

Dependence of coherent factor of microtrone ondulator radiation on acceleration mode and parameters of beam extracted from microtrone in the millimeter wavelength range is studied.It is shown, that on wavelengthes comparable with accelerating cluster size, coherent factor depends essentially on the extracted beam cross size. 8 refs.; 3 figs.

57301 **(JINR-E—9-88-310) Experimental study of simultaneous acceleration of protons and H/sup {minus}/ ions in the cyclotron.** Bejsovec, V.; Cihak, M.; Dmitrievsky, V.P.; Glazov, A.A.; Kolga, V.V.; Krivanek, M.; Thanh, L.K.; Treibal, Z.; Tucek, J.; Vasilenko, A.T. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1988. 9p. (CONF-880695—62). NTIS (US Sales Only), PC A02. Order Number DE88016986/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

The results of experimental study of simultaneous acceleration of two beams at U-120M isochronous cyclotron of INP (Rez, CSSR) are presented. Both beams of p and H/sup {minus}/ are injected from a combined ion source having two separate arc chambers placed into the central part of the accelerating chamber. The H/sup {minus}/-ion beam was accelerated up to a stripping foil mounted on a final radius, and was extracted to luminescent screen placed on the wall of accelerating chamber. The p beam was accelerated simultaneously with H/sup {minus}/ ions, went through the stripping foil and then registered on a special probe. The phase motion and some other parameters of the beams accelerated up to 22--24 MeV have been measured. 4 refs., 5 figs.

57302 **(LA-UR—88-3008) A flight-qualified RFQ for the BEAR project.** Schrage, D.; Young, L.; Campbell, B.; Billen, J.H.; Wangler, T.; Stovall, J.; Martinez, F.; Clark, W.; Gibbs, S.; Blome, G. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 5p. (CONF-881049—5). NTIS, PC A02/MF A01. Order Number DE89000369/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

A 1-MeV, 30-mA, low-duty factor, 425-MHz RFQ has been designed and constructed for the BEAR (Beam Experiments Aboard a Rocket) Project by Los Alamos National Laboratory, Grumman Space Systems Division and GAR Electroformers. The design of this 1-m-long lightweight (<55-kg) accelerator is unique in that it was constructed of four copper-plated aluminum quadrants joined longitudinally by a room- temperature electroforming process to produce a monolithic structure. There are no rf, vacuum, or mechanical joints in the vane/cavity region of the accelerator. As part of the design/fabrication process, spark-test, cold, and engineering model RFQs were constructed and tested. The completed flight unit has successfully passed static structural and thermal tests as well as dynamic structural (shake) tests according to the launch, separation, and flight specifications. In addition, the rf field distributions and beam-transport characteristics have been measured and found to satisfy the design requirements. 12 refs., 2 figs., 3 tabs.

57303 **(LA-UR—88-3206) Electromagnetic time-domain calculations in two and three dimensions.** Chan, K.C.D. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 16p. (CONF-881151—6). NTIS, PC A03/MF A01. Order Number DE89000311/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

For some time, computer codes have been available for time-domain calculations of the beam-induced electromagnetic fields in axially symmetric structures (two dimensions). Recently, these codes have been extended to three-dimensional geometries. Time-domain calculations are complementary to frequency-domain calculations in accelerator designs and represent a better approach in

some areas. Some of these areas will be reviewed in this paper and an introduction to the computer codes will be given.

57304 **(LA-UR—88-3236) Laboratory performance of the BEAR [Beam Experiment Aboard Rocket] RFQ [radio-frequency quadrupole).** O'Shea, P.G.; Schrage, D.L.; Young, L.M.; Zaugg, T.J.; Lynch, M.T.; McKenna, K.F.; Hansborough, L.D. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 12p. (CONF-881151—2). NTIS, PC A03/MF A01. Order Number DE89000320/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

The BEAR (Beam Experiment Aboard Rocket) accelerator will be part of an experiment to demonstrate the operation of an ion accelerator in space and to characterize the exoatmospheric propagation of a neutral particle beam. The RFQ (radio-frequency quadrupole) has been designed to produce a 25-mA H/sup {minus}/ beam with an emittance of 0.01 cm-mrad (rms normalized) at an energy of 1 MeV. Because of the rigors of spaceflight, the accelerator design has been constrained by factors not normally applicable to conventional terrestrial accelerators. These factors and the mechanical features are described in a companion paper in these proceedings. The design techniques developed for BEAR would be applicable whenever, rugged, lightweight, or power-efficient systems are required. The BEAR RFQ has been operated under power with beam in the laboratory. This paper details of measured beam transport, emittance, and energy spectra. 6 refs., 4 figs.

57305 **(LA-UR—88-3247) Longitudinal beam dynamics of a 5-MeV DTL [drift-tube linac]: A comparison of theory and experiment.** Fortgang, C.M.; Bolme, G.O.; Cottingame, W.B.; Johnson, K.F.; Marquardt, J.H.; Rusthoi, D.; Sander, O.R.; Worth, G.T. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 3p. (CONF-881049—14). NTIS, PC A02. Order Number DE89000344/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

A detailed comparison of theory and experiment concerning the longitudinal beam dynamics of a 2- to 5-MeV drift-tube linac (DTL) was carried out. Beam output energy and phase were measured as a function of DTL rf field amplitude and phase. Comparison between experimental data and theory was found to be in good agreement. 1 refs., 9 figs.

57306 **(LA-UR—88-3248) Analysis of measured post-coupler fields in a ramped-gradient drift-tube linac.** Billen, J.H. (Los Alamos National Lab., NM (USA)). 1988. Contract AC04-76DP00789. 3p. (CONF-881049—13). NTIS, PC A02/MF A01. Order Number DE89000343/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

Post couplers longitudinally stabilize the axial electric field in a drift-tube linac (DTL) against tuning errors. Displacing the post couplers toward one end of the structure results in a ramped field that increases toward the other end. Such a ramped-gradient DTL is also stable, but some of the cavity power is dissipated on the post couplers to maintain the ramp. This paper reports bead-perturbation measurements of the post-coupler magnetic fields near the tank well. A simple physical model reproduces the measured fields with an accuracy of about 2% and yields current-density distributions on the post couplers in terms of the current density on the cavity wall. The peak power density occurs on the sides of the post couplers where the TM_{010} magnetic field adds to the post-coupler magnetic field. In the Los Alamos Ramped-Gradient DTL (RGDTL), the peak power densities on post couplers located in the steepest part of the ramp exceed by more than 10 times the maximum power density on the tank wall far from any post couplers. Methods to reduce such power losses to levels comparable to a flat-gradient DTL will be discussed. 2 refs. , 6 figs., 1 tab.

57307 **(LA-UR—88-3259) H/sup {minus}/ beam neutralization measurements with a gridded-energy analyzer, a non-interceptive beam diagnostic.** Sherman, J.; Pitcher, E.; Allison, P. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 3p. (CONF-881049—17). NTIS, PC A02. Order Number DE89000337/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

Transport of high-perveance H/sup {minus}/ ion beams frequently depends on space-charge neutralization by a background plasma to reduce or eliminate space-charge defocusing. We have developed a four-grid energy analyzer (FGA) that measures the energy distributions of particles emitted radially from the beam-generated plasma. H/sup {minus}/ beams of 80- to 90- mA current at 21-keV beam energy (which yields a {minus}400 V potential drop for an unneutralized beam) have been studied in a 55-cm drift region using He and Xe neutralizing gases. At a sufficiently high gas density, ion energy distribution analyses show a several volt positive potential drop across the H/sup {minus}/ beam, supporting the gas focusing concept of overneutralized H/sup {minus}/ ion beams. There is a neutralizing gas density threshold below which no radially flowing positive ion current is observed. At low gas density, the GA electron current is noisy (indicating the plasma is unstable) and the measured electron distributions are consistent with an underneutralized beam. With the addition of neutralizing gas, the electron current oscillations and energies decrease. 8 refs., 7 figs., 1 tab.

57308 **(LA-UR—88-3277) Beam funneling studies at Los Alamos.** Stovall, J.E.; Guy, F.W.; Stokes, R.H.; Wangler, T.P. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 15p. (CONF-8806101—2). NTIS, PC A03/MF A01. Order Number DE89000328/JAW.

From International symposium on heavy ion inertial fusion; Darmstadt, F.R. Germany (28 Jun 1988).

Funneling two ion beams by interlacing their bunches can reduce the cost and complexity of systems producing intense beams. Applications of funneling could include accelerators for heavy ion inertial fusion, electronuclear breeding, and fusion materials irradiation. Funneling in an RFQ-like structure is an elegant solution at low energy where electric fields are needed to provide strong focusing. Discrete-element funnels, with separate focusing elements, bending magnets, rebunchers and if deflectors, are more flexible. At sufficiently high energies, magnetic-quadrupole lenses can provide strong focusing in a discrete-element funnel. Such a funnel has been designed as a preliminary example of a second funnel in the HIBALL-II accelerator system. In a simulation, two Bi^{+1} (mass = 209 amu) beams at 0.5 MeV/A, 20 MHz, 40-mA, separated by 55 cm and angled at +-6{degree} were combined into a single 80-mA beam at 40 MHz. Emittance growth was calculated, by a modified version of the PIC (particle-in-cell) code PARMILA, to be about 1%. Funnel design experience at Los Alamos has evolved rules-of-thumb that reduce emittance growth. Some of these are to maintain focusing periodicity and strength in both transverse and longitudinal directions; use strong focusing so that the bunch will be small; minimize angles of bend and rf deflection; adjust longitudinal focusing to produce a short bunch at the rf deflector; and design rf deflectors for a uniform electrical field. 4 refs., 3 figs., 2 tabs.

57309 **(SAND—88-1985C) Production, transport and injection of a cold non-magnetized electron beam for the recirculating linac.** Mazarakis, M.G.; Poukey, J.W.; Hasti, D.E.; Smith, D.L.; Haworth, M.J.; Wagner, J.S. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 3p. (CONF-881049—19). NTIS, PC A02. Order Number DE89001234/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

A new foilless diode with a non-magnetically immersed cathode was recently designed and built for the Sandia Recirculating Linear Accelerator (RLA). Because there is also no radial component of electric field at the cathode, the electron beam starts almost parallel and is matched to a solenoidal transport system with minimum increase in divergence and radius. The electrode emission surface is specified by an area covered with felt which undergoes ex-

plosive electron emission at low electrical field stresses (60 kV/cm). The 1.7-MV, 4.8-kA produced beam is transported 1.5 meters to the injection region of the racetrack via a system of solenoids and focusing coils. The maximum transverse velocity component at injection point (1.5 m downstream from the cathode surface) is B/sub {perpendicular}/ = 0.03 and the radius r = 2.8 cm which give a quite small beam emittance {var←epsilon} = 0.08 rad-cm. Three-dimensional numerical simulations suggest that tangential injection into the ion focusing regime (IFR) channel of the accelerator provides better beam-channel coupling. A 1.3-MV and 4-MV design are also described. 6 refs., 13 figs.

57310 **(SAND—88-2412C) High current beam conditioning theory.** Freeman, J.R.; Poukey, J.W.; Wagner, J.S.; Frost, C.A. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 5p. (CONF-8809149—16). NTIS, PC A02/MF A01. Order Number DE89000458/JAW.

From DARPA/SDIO services annual propagation review; Newport, RI, USA (12 Sep 1988).

B/sub Θ/ wire cells are evacuated drift that contain a current-carrying wire on axis. Electron beams injected into these cells produce an electrostatic field due to induced charge on the wire. In the same spirit, they also induce a return current that produces a magnetic field that initially almost cancels the electrostatic field in the high-γ, quasi-static regime. The resulting net force on the beam is thus almost solely due to the externally supplied wire current. This provides a robust means, unaffected by self-consistent beam forces, of centering, guiding, and conditioning election beams in short distances. 2 refs.

57311 **(SAND—88-2599C) High current beam equilibrium measurements.** Leifeste, G.T.; Frost, C.A. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 7p. (CONF-8809149—15). NTIS, PC A02. Order Number DE89001215/JAW.

From DARPA/SDIO services annual propagation review; Newport, RI, USA (12 Sep 1988).

We have used a six frame x-ray framing camera (XRFC) in a proof-of- principle experiment to measure the full 2-D spatial distribution of a high current relativistic electron beam during the establishment of its equilibrium in full pressure air. Analysis of the data illustrates the necessity for these types of measurements for use as input conditions in particle simulation codes for propagation experiments.

57312 **(SAND—88-2804C) BUCKSHOT simulations of ATA.** Wagner, J.S.; Godfrey, B.B. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 5p. (CONF-8809149—17). NTIS, PC A02/MF A01. Order Number DE89001447/JAW.

From DARPA/SDIO services annual propagation review; Newport, RI, USA (12 Sep 1988).

Recent experiments on ATA have shown that the accelerated beam can have inverse tailoring, with the beam radius increasing from head to tail. This inverse tailored beam, which is not favorable for endoatmospheric beam propagation, has been associated with high (7-kA) beam currents, and is not observed with low (3-kA) beam currents. One explanation for this is that ion motion in ATA's IFR channel disrupts the beam. To test this hypothesis we have simulated the ATA experiment using the 3-D magnetostatic particle code BUCKSHOT. 3 figs.

57313 **(UCRL—99494) Study of heavy ion beams during longitudinal compression using particle simulation.** Ho, D.D.M.; Brandon, S.T. (Lawrence Livermore National Lab., CA (USA)). 8 Aug 1988. Contract W-7405-ENG-48. 15p. (CONF-8806101—3). NTIS, PC A03/MF A01. Order Number DE89001294/JAW.

From International symposium on heavy ion inertial fusion; Darmstadt, F.R. Germany (28 Jun 1988).

Particle simulations show that during longitudinal compression, there is little growth in beam longitudinal and transverse emittance. Both longitudinal and transverse temperatures follow adiabatic laws. The compressed beam has negligible longitudinal momentum spread and therefore can satisfy stringent requirements for final focusing. 4 refs., 3 figs.

57314 **(UCRL—99686) ATA transport experiment: Triple slit emittance selector data.** Fawley, W.; Boyd, J.; Caporaso, G.; Chambers, F.; Orzechowski, T.; Struve, K.; Weir, J. (Lawrence Livermore National Lab., CA (USA)). 28 Sep 1988. Contract W-7405-ENG-48. 6p. (CONF-8809149—6). NTIS, PC A02. Order Number DE89001040/JAW.

From DARPA/SDIO services annual propagation review; Newport, RI, USA (12 Sep 1988).

A common element to most of the ATA transport experiments was a measurement of the beam's phase space properties. In general, we wanted a diagnostic that would quickly give us the time-resolved information that would quantitatively tell us how much of an effect a given "knob" or new machine element had on the beam's brightness. As explained below, it is extremely difficult to make quantitative measurements of the brightness of an ion-focused beam while it is still on the channel, nor is simple, unimpeded vacuum expansion much better. Instead, we designed and installed a simple set of three range-thick apertures beyond the fusible link which allowed us to use beam bugs to measure J over a useful range of nearly two orders of magnitude. Our results showed that the peak brightness of the beam core is a 10-15 ns spike whose temporal position follows the timing of the laser pulse and whose magnitude and duration is relatively insensitive to beam current, benzene pressure, laser intensity, profile, or timing. 2 figs., 1 tab.

57315 **Synchrotron-radiation limit on the focusing of electron beams.** Oide, K. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94309). *Physical Review Letters;* **61**: No. 15, 1713-1715(10 Oct 1988).

It is shown that there is an essential limit on the focusing of electron beams due to synchrotron radiation in the final focusing lens of a linear collider. The minimum possible beam size is determined almost only by an invariant emittance of a beam which is given at the entrance of a linear accelerator.

57316 **An improved integrally formed radio frequency quadrupole.** Abbott, S.R. US Patent Application 6-104,026. 5 Oct 1987. 14p. Contract AC03-76SF00098. NTIS, PC A03/MF A01.

An improved radio frequency quadrupole is provided having an elongate housing with an elongate central axis and top, bottom and two side walls symmetrically disposed about the axis, and vanes formed integrally with the walls, the vanes each having a cross-section at right angles to the central axis which tapers inwardly toward the axis to form electrode tips spaced from each other by predetermined distances. Each of the four walls, and the vanes integral therewith, is a separate structural element having a central lengthwise plane passing through the tip of the vane, the walls having flat mounting surfaces at right angles to and parallel to the control plane, respectively, which are butted together to position the walls and vane tips relative to each other. 4 figs.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 56958, 57204, 57205, 57207, 57309

57317 **(ANL-HEP-CP—88-39) A long polarized target for the Fermilab muon beam?.** Spinka, H. (Argonne National Lab., IL (USA)). 20 Jul 1988. Contract W-31109-ENG-38. 4p. (CONF-8806203—6). NTIS, PC A02/MF A01. Order Number DE89000580/JAW.

From Symposium on future polarization at Fermilab; Batavia, IL, USA (13 Jun 1988).

The purpose of this short talk is to initiate a discussion on the question of whether a long polarized target should be constructed for the Fermilab muon beam. 4 refs.

57318 **(BNL—41650) Injection dynamics.** Luccio, A.U.; Khiari, F.Z. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 25p. (CONF-8803129—2). NTIS, PC A03/MF A01. Order Number DE88016766/JAW.

From 4. workshop on laser switched power accelerators; Erice, Italy (4 Mar 1988).

To understand the injection process into a collider like Eloisa, we need some of the basic definitions of quantities for these machines. We will review them briefly here. 3 refs., 8 figs., 2 tabs.

57319 **(BNL—41803) Polarized ion source development at Brookhaven.** Alessi, J.G.; DeVito, B.; Hershcovitch, A.; Kponou, A.; Meitzler, C.R. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 6p. (CONF-880983—6). NTIS, PC A02/MF A01. Order Number DE89002175/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

The present AGS polarized H^- source employs a ground state atomic beam source and Cs{degree} charge exchange ionizer. It produces 30-40 μA of {rvec char}H^- at 75-80% polarization, in 500 μs pulses, 0.5 Hz. Up to 60 μA has at times been produced when the cesium beam is performing optimally. Work in progress to produce a higher intensity {rvec char}H^- source includes cooling of the H{degree} beam to 6 K and ionzation of the polarized atoms via charge exchange with D^-. Experiments to test the possibility of spin selection and focusing of H{degree} using a superconducting solenoid have been completed, and have led us back to the more conventional approach of sextupoles. 6 refs., 3 figs.

57320 **(CONF-880955—2) The ATLAS PII-ECR ion source project.** Pardo, R.C.; Billquist, P.J.; Dey, J.E. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 16p. NTIS, PC A03/MF A01. Order Number DE89000594/JAW.

From International conference on the physics of multiply-charged ions; Grenoble, France (12 Sep 1988).

The Argonne PII-ECR ion source has been operating for ten months. Beam development has proceeded well and has included the first beams from solid materials as well as gases. High voltage operation has been accomplished and beams to an atomic physics program have been provided for a total of four months. Problems with the high voltage transformer has limited run time at high voltage. A test of ion cyclotron resonance heating has occurred, demonstrating the possibility of selectively enhancing certain charge states in the extracted beam distributions. First beam from the Phase I Positive Ion Injector (PII) project is scheduled for February, 1989. 7 refs., 6 figs., 4 tabs.

57321 **(CONF-881002—4) HISTRAP [Heavy Ion Storage Ring for Atomic Physics] vacuum test stand for pressures of 10^{-12} Torr.** Johnson, J.W.; Atkins, W.H.; Dowling, D.T.; McConnell, J.W.; Milner, W.T.; Olsen, D.K. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 16p. NTIS, PC A03/MF A01. Order Number DE88016781/JAW.

From 35. national vacuum symposium and 4th international laser science conference; Atlanta, GA, USA (2 Oct 1988).

HISTRAP, Heavy Ion Storage Ring for Atomic Physics, is a proposed synchrotron/cooler/storage ring accelerator optimized for advanced atomic physics research. The ring has a circumference of 46.8 m, a bore diameter of about 15 cm, and requires a vacuum of 10^{-12} Torr in order to decelerate highly-charged very-heavy ions down to low energies. To be able to test components and procedures to achieve this pressure, a test stand approximately modeling one-sixteenth of the ring vacuum chamber has been built. The 3.5-m-long test stand has been fabricated from 10-cm-diameter components, with 316LN stainless steel flanges. Prior to assembly, these components were vacuum fired at 950{degree}C at a pressure of 10^{-4} Torr. The test stand is bakeable in situ at 300{degree}C. Pumping is achieved with two 750-L/s titanium sublimator pumps and one 60-L/s ion pump. Pressure is measured with two extractor ion gauges and a 10^{-14} PP RGA. The roughing for the test stand consists of cryosorption pumps followed by a cryopump. A pressure of 4×10^{-12} Torr has been achieved. 7 refs., 5 figs.

57322 **(CONF-8709351—1) High brightness sources for MeV microprobe applications.** Read, P.M.; Alton, G.D.; Maskrey, J.T. (Oak Ridge National Lab., TN (USA); UKAEA Harwell Lab. Nuclear Physics Div.). 1987. Contract AC05-84OR21400. 15p. NTIS, PC A03/MF A01. Order Number DE88017365/JAW.

From 1. international conference on nuclear microprobe technology and application; Oxford, UK (1 Sep 1987).

State of the art MeV ion microprobe facilities are now approaching current density limitations on targets imposed by the fundamental nature of conventional gaseous ion sources. With a view to addressing this problem efforts are under way which have the ultimate objective of developing high brightness Li liquid metal ion sources suitable for MeV ion microprobe applications. Prototype Li^+ and Ga^+ liquid metal ion sources have been designed, fabricated and are undergoing preliminary testing. This paper describes the first total emittance and brightness measurements of a Ga liquid metal ion source. The effect of the geometry of the ion extraction system is investigated and the brightness data are compared to those of a radio frequency ion source.

57323 **(CONF-8808122—5) The Oak Ridge National Laboratory slow positron source.** Hulett, L.D. Jr.; Lewis, T.A.; Donohue, D.L.; Pendyala, S. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 3p. NTIS, PC A02. Order Number DE88016807/JAW.

From 8. international conference on positron annihilation; Gent, Belgium (29 Aug 1988).

The Oak Ridge Electron Linear Accelerator (ORELA) has been retrofitted with a facility to convert forward scattered gamma bremsstrahlung to positrons. Currents of 10^8 slow positrons per second, and 10^9 fast positrons per second are delivered. The fast and slow beams can be separated and used for dual experiments. The facility operates in a parasitic mode, such that it does not interfere with the on-going nuclear program. Additional operating costs for positron production are negligible. Positrons are made available continuously, 5 days per week. A Penning trap has been constructed and will be installed for a dc positron current supply. 3 refs., 2 figs.

57324 **(LA-UR—88-3020) Mapping the fringe fields of multipole magnets.** Wadlinger, E.A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 4p. (CONF-881049—6). NTIS, PC A02/MF A01. Order Number DE89000367/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

A good method for mapping multipole magnets (suggested by K. Halbach) is to measure the magnetic field on the surface of a constant radius cylinder centered on the magnet axis. This paper presents one approach to this mapping concept using a magnetic field description that identically satisfies Maxwell's equations. The field map is used to determine the magnetic scalar potential function written in a form that reduces to a standard multipole expansion for an axially independent field. This scalar potential function is used in particle tracking codes. An example and a brief error analysis are included. 3 refs., 1 fig., 2 tabs.

57325 **(LA-UR—88-3146) Fringe fields of current dominated multipole magnets.** Wadlinger, E.A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 4p. (CONF-881049—7). NTIS, PC A02/MF A01. Order Number DE89000360/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

We determine analytic functions that describe the fringe field region of Lambertson, or cosine-wound, magnets. In particular, we are interested in determining the aberrations, up to fifth order, of a beam transiting our large-bore current-dominated quadrupoles. We determine the scalar potential from the vector potential calculated first for a single current loop and then for a 2N symmetric current loop multipole magnet. 2 refs., 1 fig.

57326 **(LA-UR—88-3149) Calculations on permanent-magnet quadrupoles with nonrectangular cross section.** Boicourt, G.P.; Merson, J.L. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 4p. (CONF-881049—9). NTIS, PC A02/MF A01. Order Number DE89000358/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

The current trend toward higher frequencies to power drift-tube linacs (DTLs) and coupled-cavity linacs (CCLs) reduces the space available for quadrupole focusing magnets. Similarly, the space available for matching sections between linac sections is limited, and often the matching section bunchers are designed in odd shapes to make them fit. This shaping further restricts focusing magnet space. One approach to attaining sufficient quadrupole strength is such situations is to use rare-earth permanent-magnet quadrupoles (PMQs) with cross sections tailored to fill as much of the available space as possible. In this paper, we describe some techniques we have developed to calculate the properties of such magnets both singly and when other magnets are nearby. 3 refs., 4 figs.

57327 **(LA-UR—88-3205) Three-dimensional rf structure calculations.** Cooper, R.K.; Browman, M.J.; Weiland, T. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 29p. (CONF-881151—5). NTIS, PC A03/MF A01. Order Number DE89000312/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

The calculation of three-dimensional rf structures is rapidly approaching adolescence, after having been in its infancy for the last four years. This paper will show the kinds of calculations that are currently being performed in the frequency domain and is a companion paper to one in which time-domain calculations are described. 13 refs., 14 figs.

57328 **(LA-UR—88-3260) The development of small-scale quadrupoles to operate at 20 to 50K.** Liska, D.J.; Kraus, R.H.; Brown, R.D.; Cost, J.R. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 3p. (CONF-881049—16). NTIS, PC A02/MF A01. Order Number DE89000336/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

The development of cryogenically cooled, high-frequency linacs at Los Alamos necessitates that small quadrupoles be developed to operate inside the drift tubes at temperatures as low as 20 K. A program has been undertaken to procure some of these quads, designed to critical specifications, and to test them for field-gradient and harmonic- distortion changes when taken down to the 20- to 50-K operating range and cycled many times back to room temperature. In this application $SmCo_5$ and Sm_2Co_{17} will be used. Both low-temperature operation and resistance to radiation damage are required of these critical components; therefore, the test program also involves exposure to high radiation fluxes in the Omega West reactor at Los Alamos, coupled with post-irradiation field tests. 2 refs., 3 figs., 1 tab.

57329 **(LA-UR—88-3261) Cavity-waveguide coupling through a large aperture.** Wang, T.F.; Thode, L.E.; Cooper, R.K. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 4p. (CONF-881049—15). NTIS, PC A02/MF A01. Order Number DE89000335/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

In designing a high-power, single-feed rf-cavity, one needs to consider the field disturbance caused by the large coupling aperture between the cavity and the waveguide. In this paper, we present and approach for studying this kind of field disturbance for modes in the frequency domain by using the three-dimensional code MAFIA. We demonstrate that by judiciously choosing the boundary conditions at the appropriate location along the waveguide, one can model the cavity-waveguide system by a closed boundary system and reduce the computation time significantly. 5 refs., 7 figs.

57330 **(LA-UR—88-3263) Studies of the four-rod RFQ [radio-frequency quadrupole] using the MAFIA codes.** Browman, M.J.; Spalek, G.; Friedrichs, P.B.; Barts, T.C. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 4p. (CONF-881049—2). NTIS, PC A02/MF A01. Order Number DE89000310/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

A four-rod frequency quadrupole (RFQ) was studied using the MAFIA codes in the hoped of reducing the maximum power loss density, an important consideration for CW operation. The 389.9-MHz calculated frequency was within 2.1% of the 407.5-MHz measured value, and a study of the magnetic field patterns showed that the current flow, and hence power loss, was concentrated at the outer part of the rods. A simple modification of the rod shape reduced the power loss density in this region, which would ease the cooling problem. This modification, however, only improved the Q of the structure by about 1%, and further studies are needed to determine if the efficiency of the structure can be significantly improved. 4 refs., 9 figs.

57331 **(LA-UR—88-3276) Studying the end regions of RFQs using the MAFIA codes.** Browman, M.J.; Spalek, G.; Barts, T.C. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 3p. (CONF-881049—10). NTIS, PC A02/MF A01. Order Number DE89000329/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

The three-dimensional MAFIA codes were used to study the end regions of a radio frequency quadrupole (RFQ). The following determinations were made: (1) Undercutting the vane is essential; (2) To a point, increasing the distance between the vanes and the end plate decreases the power loss at the ends of the vanes; this effect (assuming we begin with an end gap slightly larger than the distance between the vanes) decreases with distance and eventually reaches a limit; and (3) The slope of the undercut affects the peak current flow and the power dissipation at the ends of the vanes; in particular it was found that in designing such an end region a trade-off must be made between minimizing the peak power loss density and reducing the total power loss. This paper gives the details of the calculations leading to the above conclusions. 4 refs., 11 figs., 2 tabs.

57332 **(LBL—25925) An alternate method for designing dipole magnet ends.** Pope, W.L.; Green, M.A.; Peters, C.; Caspi, S.; Taylor, C.E. (Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC03-76SF00098. 4p. (CONF-880812—8). NTIS, PC A02/MF A01. Order Number DE89000557/JAW.

From Applied superconductivity conference; San Francisco, CA, USA (21 Aug 1988).

Small bore superconducting dipole magnets, such as those for the SSC, often have problems in the ends. These problems can often be alleviated by spreading out the end windings so that the conductor sees less deformation. This paper presents a new procedure for designing dipole magnet ends which can be applied to magnets with either cylindrical or conical bulged ends to have integrated field multipoles which meet the constraints imposed by the SSC lattice. The method described here permits one to couple existing multiparameter optimization routines (i.e., MINUIT with suitable independent parameter constraints) with a computer code DIPEND, which describes the multiples, so that one can meet any reasonable objective (i.e., minimizing integrated sextupole and decapole). This paper will describe how the computer method was used to analyze the bulged conical ends for an SSC dipole. 6 refs, 6 figs, 2 tabs.

57333 **(SAND—88-1984C) The new injector design for the upgraded RADLAC-II linear accelerator.** Mazarakis, M.G.; Poukey, J.W.; Shope, S.L.; Hasti, D.E.; Frost, C.A.; Leifeste, G.T.; Smith, D.L. (Lawrence Livermore National Lab., CA (USA)). 1988. Contract AC04-76DP00789. 4p. (CONF-881049—20). NTIS, PC A02. Order Number DE89001226/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

The cathode field shaper, shank assembly, and magnetic field profile have been redesigned for the upgraded RADLAC-II configuration. The new design incorporates our most recent experimental observations, JASON code analysis, and simulation results with the newest version of particle-in-cell (PIC) code MAGIC. A conical field shaper was selected that starts at the cathode end plate with a 10-cm diameter cylinder and tapes smoothly to the cathode tip. The field shaper is 1- m long. Three interchangeable cone tips provide for different diameter cathode tips (1.2 cm, 1.9 cm, and 2.5 cm). The simulations show that a 40 to 50-kA annular cold beam can be produced with an rms transverse velocity component B/sub perpendicular/ = 0.06 and a radius r = 0.85 cm. The total cathode shank losses are drastically reduced and the previously observed beam halo completely eliminated. Experimental results are in good agreement with the design goals. 7 refs., 9 figs.

57334 **(SAND—88-2390C) 4-MeV RLA [Recirculating Linear Accelerator] injector design considerations.** Smith, D.L.; Hasti, D.E. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 5p. (CONF-8809149—7). NTIS, PC A02/MF A01. Order Number DE89001239/JAW.

From DARPA/SDIO services annual propagation review; Newport, RI, USA (12 Sep 1988).

A new injector is required to extend the Sandia Recirculating Linear Accelerator (RLA) to more interesting voltages, currents, and pulse shapes for relativistic electron beam (REB) generation, capture, and transport experiments. The comparison and relative advantages of the more promising designs for a 4-MeV REB source are summarized. 8 refs., 3 figs., 1 tab.

57335 **(SAND—88-2500C) Recirulating linac accelerator (RLA) cold beam injector design.** Mazarakis, M.G.; Poukey, J.W.; Hasti, D.E.; Smith, D.L.; Haworth, M.J.; Wagner, J.S. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 5p. (CONF-8809149—10). NTIS, PC A02/MF A01. Order Number DE89001231/JAW.

From DARPA/SDIO services annual propagation review; Newport, RI, USA (12 Sep 1988).

A new foilless diode with a non-magnetically immersed cathode was recently designed and built for the Sandia Recirculating Linear Accelerator (RLA). Because there is also no radial component of electric field at the cathode, the electron beam starts almost parallel and is matched to a solenoidal transport system with minimum increase in divergence and radius. The electrode emission surface is specified by an area covered with felt that undergoes explosive electron emission at low electrical field stresses (60 kV/cm). The 1.7-MV, 4.8-kA produced beam is transported 1.5 meters to the injection region of the racetrack via a system of solenoids and focusing coils. The maximum transverse velocity component at injection point (1.5 m downstream from the cathode surface) is β/sub {perpendicular}/ = 0.03, and the radius, r = 2.8 cm, gives a very small beam emittance, {var←epsilon} = 0.08 rad-cm. 3-D numerical simulations suggest that tangential injection into the ion focusing regime (IFR) channel of the accelerator provides better beam-channel coupling. A 4-MV design is also described. 6 refs., 6 figs.

57336 **(SAND—88-2501C) RADLAC-II injector designs.** Mazarakis, M.G.; Poukey, J.W.; Shope, S.L.; Hasti, D.E.; Frost, C.A.; Leifeste, G.T. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 6p. (CONF-8809149—11). NTIS, PC A02/MF A01. Order Number DE89001230/JAW.

From DARPA/SDIO services annual propagation review; Newport, RI, USA (12 Sep 1988).

The cathode field shaper, shank assembly, and magnetic field profile have been redesigned for the upgraded RADLAC-II configuration. The new design incorporates our most recent experimental observations, JASON code analysis, and simulation results with the newest version of PIC code MAGIC. A conical field shaper was selected that starts at the cathode end plate with a 10-cm diameter cylinder and tapers smoothly to the cathode tip. The field shaper is 1 m long. Three interchangeable cone tips provide for different diameter cathode tips (1.2 cm, 1.9 cm, and 2.5 cm). The simulations show that a 40 to 50-kA annular cold beam can be produced with an rms transverse velocity component β/sub {perpendicular} = 0.06 and a radius r = 0.85 cm. The total cathode shank losses are drastically reduced and the previously observed beam halo completely eliminated. Experimental results are in good agreement with the design goals. 4 refs., 9 figs.

57337 **(SAND—88-2615C) Video diagnostics for relativistic electron beams.** Crist, C.E.; Leifeste, G.T. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 3p. (CONF-8809149—12). NTIS, PC A02/MF A01. Order Number DE89001229/JAW.

From DARPA/SDIO services annual propagation review; Newport, RI, USA (12 Sep 1988).

While there are many diagnostics available for use on particle beam experiments, video diagnostics provide immediate insight unequaled by other diagnostic techniques. These diagnostics provide high resolution time-resolved measurements of relativistic electron beams such as the diameter and displacement, and with proper analysis, yield moments of the distribution for radial profiles. These modern diagnostics can be configured into high-speed, gated video cameras, x-ray framing cameras, streak cameras, and optical scanners for digitizing images from film. While the video signal format of these cameras may be different (RS170, CCIR, interlaced, noninterlaced...), the use of these diagnostics can be greatly facilitated by using a single interface for all of the cameras.

57338 **(SAND—88-2724C) Achromatic magnetic lens systems for high current ion beams.** Olson, C.L. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 5p. (CONF-881049—21). NTIS, PC A02. Order Number DE89001225/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

Linear transport and focusing of voltage-ramped, high-current, ion beams over distances of several meters for light ion fusion requires an achromatic focusing system. Five types of magnetic lenses are examined, and it is shown that a single lens can be achromatic only if it is a self-field lens with I {proportional←to} $\sqrt{V}$ (I = beam current, V = beam voltage). For two lenses with deflection angle Θ {proportional←to} β/sup {minus}1/, a theorem is proved that no achromatic system is possible. However, if one lens is a self-field lens, then an achromatic system is possible. One such system, composed of a self-field lens and a solenoid lens, is shown to be achromatic and suitable for the Laboratory Microfusion Facility. 5 refs., 4 figs.

57339 **Vacuum design of advanced and compact synchrotron light sources.** Halama, H.J. (ed.); Schuchmann, J.C. (ed.); Stefan, P.M. (ed.). New York, NY; American Institute of Physics (1988). 382p. American Institute of Physics, 335 East 45th Street, New York, NY 10017. Order Number TI89000030/JAW. Contract AC02-76CH00016.

From Topical conference on vacuum design of advanced and compact synchrotron light sources; Upton, NY, USA (16 May 1988).

This book contains papers dealing with the following main topics: Vacuum considerations for synchrotron radiation sources; Machine design; Compact light sources for x-ray lithography; Surface cleaning and conditioning; Ion trapping, gas desorption, lifetime; Wigglers, undulators chamber design; and General conditioning of pumps, machines and gauges. (LSP)

57340 **Laminated magnet field coil sheath.** Skaritka, J.R. US Patent Application 6-049,909. 15 May 1987. 17p. Contract AC02-76CH00016. NTIS, PC A03/MF A01.

A method for manufacturing a magnetic cable trim coil in a sheath assembly for use in a cryogenic particle accelerator. A precisely positioned pattern of trim coil turns is bonded to a flexible substrate sheath that is capable of withstanding cryogenic operating conditions. In the method of the invention the flexible substrate sheath, with the trim coil pattern precisely location relative to a bore tube assembly of an accelerator and is then bonded to the bore tube with a tape suitable for cryogenic application. The resultant assembly can be readily handled and installed within an iron magnet yoke assembly of a suitable cryogenic particle accelerator. 1 fig.

57341 **Field free, directly heated lanthanum boride cathode.** Leung, Ka-Ngo; Moussa, D.; Wilde, S.B. US Patent Application 6-010,053. 2 Feb 1987. 20p. Contract AC03-76SF00098. NTIS, PC A03/MF A01.

A directly heated cylindrical lanthanum boride cathode assembly is disclosed which minimizes generation of magnetic field which would interfere with electron emission from the cathode. The cathode assembly comprises a lanthanum boride cylinder in electrical contact at one end with a central support shaft which functions as one electrode to carry current to the lanthanum boride cylinder and in electrical contact, at its opposite end with a second electrode which is coaxially position around the central support shaft so that magnetic fields generated by heater current flowing in one direction through the central support shaft are cancelled by an opposite magnetic field generated by current flowing through the lanthanum boride cylinder and the coaxial electrode in a direction opposite to the current flow in the central shaft.

57342 **A strong permanent magnet-assisted electromagnetic undulator.** Halbach, K. US Patent Application 6-008,689. 30 Jan 1987. 14p. Contract AC03-76SF00098. NTIS, PC A03/MF A01.

This invention discloses an improved undulator comprising a plurality of electromagnet poles located along opposite sides of a particle beam axis with alternate north and south poles on each side of the beam to cause the beam to wiggle or undulate as it travels generally along the beam axis and permanent magnets spaced adjacent the electromagnetic poles on each side of the axis of said particle beam in an orientation sufficient to reduce the saturation of the electromagnet poles whereby the field strength of the electromagnet poles can be increased beyond the normal saturation levels of the electromagnetic poles. 4 figs.

4304 Storage Rings

57343 **Layered structure in condensed, cold, one-component plasmas confined in external fields.** Schiffer, J.P. (Argonne National Laboratory, Argonne, Illinois 60439-4843). *Physical Review Letters;* **61**: No. 16, 1843-1846(17 Oct 1988).

Novel features of solids that may be formed from cold, condensed plasmas confined in external fields (storage rings or ion traps) have been investigated with molecular-dynamics calculations. Such plasmas have well defined outer surfaces and interior layers that are parallel to the outer surface. In each layer the particles are arranged in an approximate hexagonal pattern of a two-dimensional Coulomb lattice. The interactions between layers have also been investigated: They are relatively stronger in the straight (commensurate) and virtually absent in the curved (incommensurate) directions.

44 INSTRUMENTATION

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 57234, 57436, 57485, 57708, 57965, 57968, 57982, 58094

57344 **(BNL—41347) Gettering in high resistive float zone silicon wafers for silicon detector applications.** Li, Z.; Kraner, H.W. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 9p. (CONF-881103—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012136/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

Experiments on intrinsic gettering of high resistive float-zone silicon wafers used for silicon position sensitive detectors lead to reduction of detector leakage current. Minority carrier life-time of gettered Si wafers was increased and measurements of C-V characteristics of gettered Si wafers also indicate that the gettering process produces an improved SiO_2/Si interface. Intrinsic gettering was also compared with As-implanted and P-diffused back side gettering and found to be superior in this study.

57345 **(BNL—41600) Development and tests of an anode readout TPC with high track separability for large solid angle relativistic ion experiments.** Lindenbaum, S.J.; Foley, K.J.; Eiseman, S.E.; Etkin, A.; Hackenburg, R.W.; Longacre, R.S.; Love, W.A.; Morris, T.W.; Platner, E.D.; Saulys, A.C.; Chan, C.; Kramer, M.A.; Hallman, T.J.; Madansky, L.; Bonner, B.E.; Buchanan, J.A.; Clement, J.M.; Corcoran, M.D.; Kruk, J.W.; Miettinen, H.E.; Mutchler, G.S.; Nessi-Tedaldi, F.; Nessi, M.; Phillips, G.C.; Roberts, J.B. (Brookhaven National Lab., Upton, NY (USA)). 18 Jul 1988. Contract AC02-76CH00016;AC02-76ER03274;AS05-81ER40032;AC02-83ER40107. 9p. (CONF-880867—5). NTIS, PC A02/MF A01. Order Number DE88016729/JAW.

From 24. international Rochester conference on high energy physics; Munich, F.R. Germany (4 Aug 1988).

We have developed, constructed and tested an anode readout TPC with high track separability which is suitable for large solid angle relativistic ion experiments. The readout via rows of short anode wires parallel to the beam has been found in tests to allow two-track separability of ~2-3 mm. The efficiency of track reconstruction for events from a target, detected inside the MPS 5 KG magnet, is estimated to be >90% for events made by incident protons and pions. 15 GeV/c x A Si ion beams at a rate of ~25 K per AGS pulse were permitted to course through the chamber and did not lead to any problems. When the gain was reduced to simulate the total output of a minimum ionizing particle, many Si ion tracks were also detected simultaneously with high efficiency. The resolution along the drift direction (parallel to the MPS magnetic field and perpendicular to the beam direction) was <1 mm and the resolution along the other direction {perpendicular} to the beam direction was <1 mm also. 3 refs., 5 figs.

57346 **(CONF-881032—1) A new dosimeter calibration laboratory at ORNL.** Casson, W.H.; Sims, C.S. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01. Order Number DE89001210/JAW.

From 2. conference on radiation protection and dosimetry; Orlando, FL, USA (31 Oct 1988).

The Dosimetry Applications Research (DOSAR) group at Oak Ridge National Laboratory has established a national and international program for dosimetry testing and intercomparison. Under this program there have been twenty-two nuclear accident dosimeter intercomparisons conducted with a frequency of about one each a year. The primary tool used in these studies as well as in a wide variety of biological experiments, personnel training programs, and other nuclear and radiation related work has been the Health Physics Research Reactor. Currently the availability of the reactor is uncertain, and it is desirable to have alternate reliable radiation sources to continue an increasing workload. An important part of the research done at DOSAR involves calibrating several different types of equipment with known sources traceable to the National Bureau of Standards (NBS). These calibrations, although done with sufficient accuracy using available sources, were conducted in a casual manner and often resulted in undesirable exposures to the researchers and posed a general inconvenience to the smooth operation of the facility. Although extensive laboratory space and storage was available at the facility, there were no facilities for a permanent irradiation setup that could house all the neutron, gamma, and beta sources necessary.

57347 **(CONF-8808122—4) A theorem for the determination of resolution functions for positron lifetime spectrometry.** Hulett, L.D. Jr.; Pendyala, S. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01. Order Number DE88016805/JAW.

From 8. international conference on positron annihilation; Gent, Belgium (29 Aug 1988).

A theorem that describes how first approximations of resolution functions of positron lifetime spectrometers can be extracted from spectra of standard specimens is derived and demonstrated. If the long-lifetime components of the intrinsic spectrum of the standard are small, the resolution function is given approximately by the following relationship: $R(t) = C(t) + T^*[dC(t)/dt]$ where C(t) is

the experimental spectrum and T is a fitting parameter, approximately equal to the dominant lifetime. 1 ref., 3 figs., 1 tab.

57348 **(DP-MS—88-122) Low level on-line alpha monitoring system for aqueous streams.** Salaymeh, S.R. (Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 6p. (CONF-8810112—1). NTIS, PC A02/MF A01. Order Number DE88015683/JAW.

From 34. annual conference on bioassay, analytical and environmental radiochemistry; Las Vegas, NV, USA (17 Oct 1988).

An improved On-Line Alpha Monitor (OLAM-100S) was developed for monitoring alpha activity in aqueous streams which may contain traces of radioactivity. This new system uses an improved alpha particle detector NE-810 plastic scintillator. Laboratory testing of the instrument has established its sensitivity, accuracy, precision and linearity at low levels of alpha activity. It has shown to be three times as sensitive as the IRT OLAM-100 which uses a cerium-activated Vycor glass scintillator as a detector. Concentrations of 238-plutonium as low as 5 {times} 10/sup {minus}8/ g/l were detected. In order to evaluate its performance the instrument was subjected to a field testing and evaluation program on a stream which contains extremely low levels of activity. Results of this testing program indicate that the system is very stable, reliable, and can measure low alpha activity in streams containing fission products. 6 refs., 3 figs.

57349 **(EFI—954(4)-87) Experimental setup for measurements of proton polarization.** Avakyan, R.O.; Avetisyan, A.Eh.; Ajvazyan, R.B. and others. (Erevanskij Fizicheskij Inst. (USSR)). 1987. 18p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704316/JAW.

Experimental setup allowing to mesure simultaneously P/sub XZ/ and P/sub Y/ components of the proton polarization vector at energies of 100-300 MeV photo- and electroproductions of particles is described. By means of the setup there has been measured the proton polarization in the $\gamma p \rightarrow p\pi^0$ reaction at π^0-meson angles of 70-80 deg in the center-of-mass system for the resonance energy range as well as the polarization of cumulative protons in the $\gamma A \rightarrow PX$ reaction. 5 refs.; 8 figs.

57350 **(IAEA-R—4163-F) Improvement of the calibration technique of clinical dosemeters. Final report for the period September 1985 - December 1987.** Ehlin Caldas, L.V. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). (International Atomic Energy Agency, Vienna (Austria)). Aug 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704334/JAW.

Clinical dosemeters constituted of ionization chambers connected to electrometers are usually calibrated as whole systems in appropriate radiation fields against secondary standard dosemeters in calibration laboratories. This work reports on a technique of component calibration procedures separately for chambers and electrometers applied in the calibration laboratory of IPEN-CNEN, Brazil. For electrometer calibration, redundancy was established by using a standard capacitor of 1000pF (General Radio, USA) and a standard current source based on air ionization with Sr/sup 90/ (PTW, Germany). The results from both methods applied to several electrometers of clinical dosemeters agreed within 0.4%. The calibration factors for the respective chambers were determined by intercomparing their response to the response of a certified calibrated chamber in a Co/sup 60/ calibration beam using a Keithley electrometer type 617. Overall calibration factors compared with the product of the respective component calibration factors for the tested dosemeters showed an agreement better than 0.7%. This deviation has to be considered with regard to an uncertainty of 2.5% in routine calibration of clinical dosemeters. Calibration by components permits to calibrate ionization chambers one at a time for those hospitals who have several ionization chambers but only one electrometer (small hospitals, hospitals in developing countries). 6 refs, 2 figs, 2 tabs.

57351 **(IFVE-OEIUNK—87-185) Methodical aspects of soft hadron-proton interaction physics at EHS.** Verber, F.; Makharadze, T.G.; Perevozchikov, V.M.; Fisyak, Yu.V.; Montanet, L. (Universitaire Instelling Antwerpen (Belgium); Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij; European Organization for Nuclear Research, Geneva (Switzerland)). (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1987. 13p. (In Russian). (CERN-NA—27). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704340/JAW.

The paper is devoted to the technical aspects of multiparticle physics with European Hybrid Spectrometer. This includes the track reconstruction without bubble chamber measurements, the computation of the efficiencies and the identification of particles with ISIS. The method is illustrated with inclusive spectra of charged particles from π^-/p interactions at 360 GeV/c. 15 refs.; 6 figs.; 1 tab.

57352 **(IFVE-ORI—87-191) Sensitivity functions of multisphere neutron spectrometers.** Kryuchkov, V.P.; Semenova, G.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1987. 32p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704341/JAW.

Submitted to the journal Instrum. Exp. Tech. .

A method to calculate neutron response matrix (RM) of thermal neutrons detector (crystal LiJ(Eu)4x4 mm) in moderating spheres from 0.95 g/cm/sup 3/ polyethylene ranging from 10/sup -2/ eV to 4x10/sup 2/ MeV is presented. The calculated RM are compared with the experimental data as well as with those of other authors. The proposed modifications of the sphere detectors allowed one to improve their energy resolution and sensitivity to neutrons with $E>20$ MeV. The calculated RM are presented both for the traditional set of the Bonner spectrometer moderators and modified sphere detectors. 15 refs.; 14 figs.; 7 tabs.

57353 (INIS-mf—11311, pp 13) **Influence of different preparation methods of CaSO/sub 4/:Dy thermoluminophors on the glow curve structure.** Karpov, N.; Fellinger, J. (Moskovskij Gosudarstvennyj Univ. (USSR); Technische Univ., Dresden (German Democratic Republic). Sektion Physik). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57354 (INIS-mf—11311, pp 9) **Beta dosimetry with thin TL detectors.** Fellinger, J. 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57355 (INIS-mf—11311, pp 6) **Comparison of three types of Czechoslovak neutron personal dosemeters.** Studena, J.; Prusa, J.; Trousil, J.; Spurny, F.; Prouza, Z. (IRPAR (Czechoslovakia); IBNM (Czechoslovakia)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57356 (INIS-mf—11311, pp 8) **Properties of LiF (Mg, Cu, P) Tl chips produced at the INP Krakow.** Niewiadomski, T.; Ryba, E.; Godek, J. (Institute of Nuclear Physics, Krakow (Poland)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57357 (INIS-mf—11311, pp 9) **Calibration of multielement beta dosimeters.** Lieskovsky, M.; Carny, P. (Nuclear Power Plant Research Institute, Trnava (Czechoslovakia)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57358 (INIS-mf—11311, pp 10) **Dose rate measurements using TL detectors.** Doerschel, B.; Fellinger, J. 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57359 (INIS-mf—11311, pp 11) **Accident dosimetry at nuclear power plants with natural and manufactured RTL-detectors.** Vlasov, V.; Fatkulbajanova, N.; Kirjuchin, O.; Karpov, N. (Moskovskij Gosudarstvennyj Univ. (USSR)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57360 (INIS-mf—11311, pp 11) **Dosimetric properties of an electret ionization chamber made from polystyrol.** Seifert, H.; Doerschel, B.; Schwenteck, T.; Pretzsch, G.; Schoenmuth, T. 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57361 (INIS-mf—11311, pp 11-12) **Dosimetry of medium doses utilizing colour changes of a material.** Darickova, A. (Technical University of Prague (Czechoslovakia). Faculty of Nuclear Science and Physical Engineering). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57362 (INIS-mf—11311, pp 12) **Stability of corona-charged electrets.** Schoenmuth, T. 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57363 (INIS-mf—11311, pp 12) **Sensitivity of a coaxial dual ionization chamber against fast neutrons.** Seifert, H.; Henniger, J.; Doerschel, B. 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57364 (INIS-mf—11311, pp 16) **Remarks on cavity ionization theory applied to neutron dosimetry with the ionization chambers.** Pszona, S. (Institute for Nuclear Studies, Otwock-Swierk (Poland)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57365 (INIS-mf—11311, pp 18-19) **Biosensors: also useful for determination of ionizing radiation products?.** Prokert, K. 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57366 (INIS-mf—11311, pp 19) **Computerized glow curve analysis - a simple task?.** Sahre, P. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57367 (INIS-mf—11311, pp 20) **Dosimetric control system for inchass nuclear reactor.** Viragh, E.; Gyurkocza, C.; Molnar, F. (Technical University of Budapest (Hungary). Inst. of Nuclear Technics). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57368 (INIS-mf—11311, pp 18) **Neutron spectroscopy with TNDD.** Kubu, M. (Research Institute of Preventive Medicine, Bratislava (Czechoslovakia)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57369 (INIS-mf—11311, pp 10) **Utilization of TLD in cosmic dosimetry.** Schmidt, P.; Fellinger, J. 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57370 (INIS-mf—11311, pp 10) **Utilization of solid state nuclear track detectors in radiation experiments.** Marenyi, A.A. (Institut Mediko-Biologicheskikh Problem, Moscow (USSR)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57371 (INIS-mf—11311, pp 9-10) **Track structure theory and high-LET response of LiF.** Michael, P.; Waligorski, R. (Institute of Nuclear Physics, Krakow (Poland)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57372 (INIS-mf—11311, pp 17) **Configurations of MOS sensor systems for measurements in neutron fields.** Streubel, G.; Reinhard, J.; Schoop, K.; Doerschel, B.; Hahn, B.; Kadner, K. 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57373 (INIS-mf—11311, pp 17) **MOS-reader based on one-chip-micro-computer.** Schoop, K.; Rambach, U. 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57374 (INIS-mf—11311, pp 17-18) **Simple fast neutron detector.** Andreeff, M.; Weber, K.H. (VEB RFT Messelektronik Otto Schoen, Dresden (German Democratic Republic)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57375 (INIS-mf—11311, pp 18) **Iodine aerosol probe for monitoring the air contamination of the environment.** Sowa, W.; Minor, M.; Schubert, B. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57376 (INIS-mf—11311, pp 19) **Preparation and properties of thin fissile radiators (poster).** Streubel, G.; Hahn, T. 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57377 (INIS-mf—11311, pp 20) **Evaluation of the detection efficiency of Ge(Li)-detectors for γ-ray-emitting extended sources of the environmental monitoring program.** Knobus, B.; Rossbander, W. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57378 (INIS-mf—11311, pp 20) **Problems of measuring aerosols in the field of radiation protection by ventilation systems.** Stepanek, E. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57379 **(IPEN-Pub—127) Dosimetric properties of Li/sub 2/ B/sub 4/ O/sub 7/: Tm pellets.** Rzyski, B.M.; Morato, S.P. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Oct 1987. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703589/JAW.

Pellets produced out of thulium doped lithium tetraborate, (Li/sub 2/B/sub 4/O/sub 7/:Tm), for thermoluminescent, (TL), dosimetry present low sensibility to environment conditions. Humidity, ambiet temperature, fading and handling during TL reading have almost no influence on the TL properties of the pellets prepared according the receipt given in this paper. The structure of the TL glow curve for the irradiated Li/sub 2/B/sub 4/O/sub 7/: Tm pellet is rather simple and the TL response is linear in the range of 3x10/sup -4/ to 7x10/sup 2/Gy. The dosimetric properties of Li/sub 2/B/sub 4/O/sub 7/: Tm in pellet form makes it a competitor with other TL phosphors.

57380 **(ITEF—217(1987)) Installation for testing the L3 hadron calorimeter proportional chambers using cosmic muons.** Aref'ev, A.V.; Burov, S.I.; Vorob'ev, I.I. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 20p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704365/JAW.

Hadron calorimeter is one of the main detectors of the L3 installation, which in under construction at CERN for the work with the LEP colliding e/sup +/e/sup -/-beams. The central part of the hadron calorimeter presents a set of 9 rings with 16 modules in each. The module, in its turn, consists of alternating layers of absorber and detector. Depleted uranium 5 mm thick serves as the absorber and proportional chambers are the detectors. Characteristics of the installation for testing of the chambers are given. Using the installation the following characteristics were measured:1. the current of each chamber channel in the absence of ionization sources at the stage of its assembling with the necessary training or replacement of the wire; 2. gas amplification factor (G) of each channel and its homogeneity within each chamber using the natural uranium background; 3. long-time operation of the chambers under conditions close to the real ones; 4. chamber air tightness and high-voltage strength. The installation design basis comprises a micromodule stack with plates of depleted uranium and a system of 3 scintillation counters, as well as 3 couples of coordinate chambers. It also comprises a control (reference-point) chamber, additional proportional counter, a system of pressure and temperature sensors and recording electronics. The installation operates on-line with the SM 1420 minicomputer. The installation has worked for nearly a year without considerable failures. 2200 chambers have been tested in the period. 5 refs.; 12 figs.

57381 **(JINR—13-87-680) Ion beam monitor.** Evtisov, S.V.; Egorov, V.G.; Yanicki, M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1987. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704377/JAW.

System including microcomputer is described. It enables to controle automatically the position and profiles of four ion beams at the output of on-line mass spectrometer (0.1-10 nA ion current range), using wire coordinate transducer. It is also intended for measurement of accelerating voltage and analyzing magnetic field of the separator for identification of mass number of separated isotopes on the basis of obtained data. 1 ref.; 5 figs.

57382 **(PINSTECH/RIAD—113) Guide to shielding calculations for the design of fluoroscopic laboratory at 503 workshop AVN base Rawalpindi.** Din, J.U.; Ahmad, M.; Ashraf, M.M.; Khan, A.R.; Khan, A.A. (Pakistan Inst. of Nuclear Science and Technology, Islamabad (Pakistan). Radiation and Isotope Application Div.). Nov 1986. 38p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704405/JAW.

Non-destructive testing plays an important role in assessing the quality of materials. Various methods are used for this purpose. Radiography by X-rays and gamma-rays is one of the NDT methods used. There are number of mathematical formulae used to estimate the required shielding for an X-ray tube operating at maximum rated voltage or a gamma radiation source having fixed energies. This report covers the shielding requirements for a 150 KV constant potential X-ray unit operating at maximum rated voltage. In addition, the report is a guide for the design of shielded enclosure required for X-rays machines in general. (orig./A.B.). 33 fig.

57383 **(PNL-SA—15532) Operation of a proficiency testing laboratory for radiation dosimeters.** McDonald, J.C. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1988. Contract AC06-76RL01830. 12p. (CONF-8808134—1). NTIS, PC A03/MF A01. Order Number DE88015932/JAW.

From National conference of standards laboratory workshop and symposium; Washington, DC, USA (14 Aug 1988).

Among other functions, the Pacific Northwest Laboratory (PNL) tests and calibrates instruments and dosimeters that are used to measure the quantity of radiation to which workers may be exposed. One of the projects that is carried out by PNL's Health Physics Department is the operation of a proficiency testing laboratory for radiation dosimeters. This paper describes the capabilities and the operational details of the laboratory. In order to perform its tasks, it is essential that the laboratory have a wide range of radiation sources along with the testing apparatus necessary to assure the quality of instrument and dosimeter performance. It is also necessary to demonstrate that instrument and dosimeter calibrations are consistent with national standards. 5 refs.

57384 **(PTB-FMRB—117) Radiation protection instruments based on tissue equivalent proportional counters: Part II of an international comparison.** Alberts, W.G.; Dietz, E.; Guldbakke, S.; Kluge, H.; Schumacher, H. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Forschungs- und Messreaktor). Apr 1988. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755192/JAW.

This report describes the irradiation conditions and procedures of Part II of an international intercomparison of tissue-equivalent proportional counters used for radiation protection measurements. The irradiations took place in monoenergetic reference neutron fields produced by the research reactor and accelerator facili-

ties of the PTB Braunschweig in the range from thermal neutrons to 14.8 MeV. In addition measurements were performed in /sup 60/Co and D/sub 2/O-moderated /sup 252/Cf radiation fields. Prototype instruments from 7 European groups were investigated. The results of the measurements are summarized and compared with the reference data of the irradiations.

57385 (RCNP-P—95, pp 39-42) **Laser and gas counters.** Matoba, Masaru. (Kyushu Univ., Fukuoka (Japan)). 1988. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780003/JAW. (CONF-8712117—).

From Workshop on lasers in nuclear physics; Ibaraki, Japan (8 Dec 1987).

Tests and studies of characteristics of gas counters with laser are evaluated. Experiments for the ionization of counter gas with laser, laser induced pulsed X-ray sources and the enhancement of ionization in a gas counter with laser are discussed.

57386 (RCNP-P—95, pp 116-121) **Microwave single photon counting by using Rydberg atoms and its application for searching invisible axions.** Fukuda, Yukio; Matsuki, Seishi. (Kyoto Univ. (Japan). Dept. of Physics). 1988. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780003/JAW. (CONF-8712117—).

From Workshop on lasers in nuclear physics; Ibaraki, Japan (8 Dec 1987).

A high sensitivity single photon counting method using Rydberg atoms is discussed and shown to be a promissing technique for detecting microwave photons converted from cosmic axions in a strong magnetic field by the Primakov effect. This method could give much better results compared with conventional methods.

57387 (RNIIRP—87-2) **Approximation of calibration parameters of measuring converters.** Mussonov, G.P. (Rizhskij Nauchno-Issledovatel'skij Inst. Radioizotopnogo Priborostroeniya (USSR)). 1987. 26p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704407/JAW.

The possibility to improve accuracy characteristics of radioisotope measuring devices (RMD) by using microprocessors and improving algorithms of computation process arrangement is discussed. Algorithms of piecewise-functional approximation of calibration dependences by algebraic and fraction-rational functions not higher that the second order and exponential functions are investigated. Problems of the interval length and boundary determination from the condition of preset approximation error ensurance are solved. To determine the unknown coefficients of the approximating functions the least square fit with alternating weight coefficients is used, the iteration use of which permits to eliminate accidental gross errors in the experiments. The algorithms considered permit to ensure any preset approximation error with the minimum time of calculation performance during measurements. 5 refs.; 5 figs.; 2 tabs.

57388 (SIN-PR—87-08) **Cryogenic detectors.** Zehnder, A. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)). 5 Nov 1987. 20p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704408/JAW.

Presently the development of new large scale detector systems, used in very high energy physics experiments, is very active. In the low energy range, the introduction of charge coupled devices allows improved spacial and energy resolution. In the keV region, high resolution can only be achieved via the well established diffraction spectrometers with the well-known disadvantage of a small throughput. There exist no efficient detectors for non-ionizing radiation such as coherent nuclear scattering of weakly interacting particles. The development of high resolution solid state detectors in the keV-region with the possibility of nuclear recoil detection is therefore highly desired. Such detectors applied in astro and particle physics would thus allow one to obtain new information not achievable otherwise. Three types of cryogenic detectors exist: Calorimeters/Bolometers. This type is sensitive to the produced excess phonons and measures the deposited energy by detecting the heat pulses. Excess charge carriers should be used to produce phonons. Tunneling junctions. This type is sensitive to excess charge produced by the Cooper pair breakup. Excess phonons should be used to break up Cooper pairs. Superheated superconducting granules (SSG). An SSG detector consists of granules, the metastability of which is disturbed by radiation. The Meissner effect then causes a change in the field distribution of the applied external field, which can be detected. The present paper discusses the basic principle of calorimetric and tunneling junction detectors and some of their applications. 26 refs., 7 figs., 1 tab.

57389 (SSI—87-01) **Radon chamber for soil gas detectors. Construction of a radon chamber and development of methods for calibration of detectors to measure radon in soil gas.** Andersson, P. (Sveriges Geologiska AB, Malaa). (National Inst. of Radiation Protection, Stockholm (Sweden)). 9 Jan 1987. 93p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755273/JAW.

Swedish Geological Co (SGAB) has designed and constructed a chamber for the calibration of detectors and instruments intended for the measurement of radon-222 in soil gas. In the chamber radon detectors may be exposed in a model environment which simulates ground conditions with respect to radon concentration, temperature and humidity. Also included in the research project is the development of methods for calibration procedures, together with test measurements. In general, these measurements indicate that the radon detectors tested are sufficiently accurate and reliable for radon measurements in Swedish soils if they are calibrated in an environment which simulates ground conditions.

57390 (TRI—86-1) **Proceedings of the DASS/SASP (Dual Arm Spectrometer System/Second Arm Spectrometer) workshop.** Walden, P.L.; Iqbal, M.J. (eds.). (TRIUMF, Vancouver, British Columbia (Canada); Alberta Univ., Edmonton (Canada)). Dec 1986. 127p. (CONF-8603251—). NTIS (US Sales Only), PC A07. Order Number DE88016480/JAW.

From DASS/SASP (Dual Arm Spectrometer System/Second Arm Spectrometer) workshop; Vancouver, Canada (17 Mar 1986).

This report contains papers that discuss the physics that could be done with a dual arm spectrometer system. Uses in pion production physics and nucleon physics are discussed. Conceptual design of experimental facilities are also discussed. Selected papers have been processed for inclusion on the energy data base.

57391 (UCRL—99555) **The development and characterization of neutron-damaged GaAs x-ray detectors.** Springer, P.T. (Lawrence Livermore National Lab., CA (USA)). 9 Sep 1988. Contract W-7405-ENG-48. 5p. (CONF-8809105—7). NTIS, PC A02/MF A01. Order Number DE89000690/JAW.

From SPIE O-E Lase: international symposium and exhibition on fiber optics, optoelectronics and laser applications; Boston, MA, USA (6 Sep 1988).

Photoconductive x-ray detectors are becoming an important x-ray diagnostic as a result of their small size, fast response time, and high sensitivity. We are developing a discrete array of neutron-damaged GaAs detectors to be used in an imaging x-ray spectrometer, and we describe herein the techniques we use to fabricate and characterize them for an upcoming experiment. Using a 225-ps x-ray pulse from a laser-produced plasma, we measured the sensitivity and time response of the detectors to be 7.1 mA/W and on the order of 150 ps FWHM, respectively. The carrier mobility is 741 cm²/V{center←dot}s at a bias of 2 {times} 10⁴V/cm. 6 figs.

57392 **Gaseous leak detector.** Juravic, F.E. Jr. (to Dept. of Energy, Washington, DC). US Patent 4,761,553. 2 Aug 1988. Filed date 6 Oct 1983. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A mass-spectrometer type of leak detector is described for detecting gaseous atoms of a predetermined mass comprising: a rigid housing; an ion-detecting target means having an active detecting area; ionization means for ionizing the atoms to produce ions; accelerating means for accelerating the ions in a first direction; path defining means comprising a series of spaced apart baffles fixed to the housing and disposed along the path to define the boundary of the path, and to deflect ions which cross the boundary

of the path; deflecting means comprising a magnet with generally opposed spaced apart pole pieces for generating a magnetic field having a first portion with generally parallel lines of force between the pole pieces and a fringe area portion with generally non-parallel lines of force outside the pole pieces; and means for positioning the deflecting means with respect to the rigid housing, accelerating means and ion-detection target means such that a magnetic field generated by such deflection means orthogonally intersects the ion path for deflecting the ions away from the first direction so as to form a concave path of ions extending from the accelerating means through the baffles and to the active collecting area of the ion-detecting target means with substantially the entire concave ion path being in the magnetic field.

57393 **Dead-time compensation for a logarithmic display rate meter.** Larson, J.A.; Krueger, F.P. US Patent Application 6-104,029. 5 Oct 1987. 21p. Contract AC02-76CH03000. NTIS, PC A03/MF A01.

An improved circuit is provided for application to a radiation survey meter that uses a detector that is subject to dead time. The circuit compensates for dead time over a wide range of count rates by producing a dead-time pulse for each detected event, a live-time pulse that spans the interval between dead-time pulses, and circuits that average the value of these pulses over time. The logarithm of each of these values is obtained and the logarithms are subtracted to provide a signal that is proportional to a count rate that is corrected for the effects of dead time. The circuit produces a meter indication and is also capable of producing an audible indication of detected events. 5 figs.

57394 **High-efficiency scintillation detector for combined detection of thermal and fast neutrons and gamma radiation.** Chiles, M.M.; Mihalczo, J.T.; Blakeman, E.D. US Patent Application 6-019,738. 27 Feb 1987. 9p. Contract AC05-84OR21400. NTIS, PC A02/MF A01.

A scintillation based radiation detector for the combined detection of thermal neutrons, high-energy neutrons and gamma rays in a single detecting unit. The detector consists of a pair of scintillators sandwiched together and optically coupled to the light sensitive face of a photomultiplier tube. A light tight radiation pervious housing is disposed about the scintillators and a portion of the photomultiplier tube to hold the arrangement in assembly and provides a radiation window adjacent the outer scintillator through which the radiation to be detected enters the detector. The outer scintillator is formed of a material in which scintillations are produced by thermal-neutrons and the inner scintillator is formed of a material in which scintillations are produced by high-energy neutrons and gamma rays. The light pulses produced by events detected in both scintillators are coupled to the photomultiplier tube which produces a current pulse in response to each detected event. These current pulses may be processed in a conventional manner to produce a count rate output indicative of the total detected radiation event count rate. Pulse discrimination techniques may be used to distinguish the different radiations and their energy distribution.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

57395 **(BNL—41690) Fast neutron damage in silicon detectors.** Kraner, H.W.; Li, Z.; Poesnecker, K.U. (Brookhaven National Lab., Upton, NY (USA); Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Aug 1988. Contract AC02-76CH00016. 19p. (CONF-8806235—1). NTIS, PC A03/MF A01. Order Number DE88016737/JAW.

From International conference on advanced technology and particle physics; Como, Italy (12 Jun 1988).

Radiation effects of fast neutrons have been measured in silicon detectors of varying resistivity irradiated to $\sim 10^{11}$ n/cm^2 over periods of weeks. The principal damage effect is increased leakage current due to generation of carriers from defect levels in the depletion region. Damage and leakage current constants have been established for detector resistivities between 10 and 27,000 ohm-cm and lie in the range of 0.7 {minus} 2 {times} 10E7 sec/cm^2 (K) for PuBe neutrons. A slight increase in K was observed for higher resistivities which translates into somewhat improved radiation hardness. A fit of this data was attempted to a two-level recombination formulation of the damage constant. 13 refs., 6 figs., 1 tab.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 56598, 57075, 57201, 57243, 57389, 57433, 57744, 58241

57396 **(BNL—41531) High resolution electron microscopy for structure and mapping.** Hainfeld, J.F.; Wall, J.S. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 17p. (CONF-8809140—1; BIO—4465). NTIS, PC A03. Order Number DE88016736/JAW.

From Science writer's workshop on biotechnology and the human genome; Upton, NY, USA (14 Sep 1988).

Electron microscopes are very valuable to the human genome project. Brookhaven's Scanning Transmission Electron Microscope (STEM) is unique in many respects. It is like the National Synchrotron Light Source (NSLS) or the High Flux Beam Reactor (HFBR) at Brookhaven, but on a much smaller scale. The STEM uses electrons that are focussed through the sample, and detected. It is a scanning microscope because it scans the beam much like a television set. This is in contrast to most electron microscopes that are fixed beam, flood the sample with electrons, and then use a lens after the sample that reimages the material at higher magnification. There are some advantages to scanning, which will also be described. 19 figs.

57397 **(CONF-8808122—1) The practicality of high magnification imaging by positron emission.** Hulett, L.D. Jr.; Pendyala, S. (Oak Ridge National Lab., TN (USA); State Univ. Coll., Fredonia, NY (USA)). 1988. Contract AC05-84OR21400. 3p. NTIS, PC A02. Order Number DE88016806/JAW.

From 8. international conference on positron annihilation; Gent, Belgium (29 Aug 1988).

The positron emission microscope has the capability of contrasting areas having high concentrations of monatomic vacancies and other defects. Since the positrons traveling through the specimen will have energies of the same magnitude as that of valence electrons, image contrast will be sensitive to the chemistry of the specimen. In the near future resolutions of 10 nm or lower will be achieved. Whether or not optical aberrations will permit one atom resolution is not clear. For one atom resolution to be obtained positron emission fluxes must be brightness enhanced to 10^{11} sec{sup{minus}1}cm{sup{minus}2} or greater. 5 refs., 1 fig.

57398 **(DOE/CE/40626—T3) Measurement of black liquor surface tension: Technical report No. 3.** Krishnagopalan, J. (Maine Univ., Orono (USA)). Sep 1987. Contract AC02-83CE40626. 262p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE88015384/JAW.

Surface tension and density of two kraft black liquors were measured at a series of temperatures, from a minimum value when gas bubbles can be blown into the liquor to a maximum value near the elevated boiling point of a particular sample. Available methods for the measurement of surface tension were evaluated critically and, as a result, the maximum bubble pressure method was selected. Varying the flow rate of the gas changes the frequency of bubble formation and thereby the age of the surface. The parameter has been utilized by many researchers to monitor the diffusion of low surface energy components (e.g., surfactants) to the liquid/air interface. The effect of bubble frequency when tested with a few pure liquids, indicated that the dynamics of bubble formation had to be further examined to separate out inertial and viscous effects from purely surface tension related pressure. The pressure versus flow rate data were extrapolated to zero flow rate and surface tension and density were calculated using these extrapolated values. As expected, surface tension decreased with increasing temperature for all the samples. Surface tension decreases with increasing solids content (when compared with the value for water) to a certain level (about 20%) and it starts to increase again. The decrease in surface tension in the dilute black liquor, is probably due to the decrease in the concentration of water, which has a high surface tension value. The occurrence of the minimum is probably due to the

effect of inorganic components dominating over the effect of surfactants and other components. Reduction in the solubilities of the inorganics, promotion of micelles of the surfactants and reduction in the diffusion of surfactants to the surface, also could contribute to this phenomenon. 54 refs., 54 figs., 12 tabs.

57399 **(IC—87/379) Non-interference and non-diffraction grating.** Wang Shaomin; Lin Qiang; Lu Xuanhui. (International Centre for Theoretical Physics, Trieste (Italy); Hangzhou Univ., ZH (China). Dept. of Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1987. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703519/JAW.

A non-interference and non-diffraction grating with right angle grooves is designed and made. Clear one to one non-Gaussian imaging is obtained and it has the ability to compensate distortions. It is a new optical device with unit magnification that could be used on compact copy machine. (author). 2 refs, 3 figs.

57400 **(JINR-R—10-87-815) CAMAC autonomous crate controller based on the KP1810BM86 16-bit microprocessor.** Hons, Z.; Sidorov, V.T.; Czizek, P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1987. 16p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704394/JAW.

CAMAC autonomous crate-controller is described. It consists of 2 modules: a microcomputer based on the KP1810BM86 16-bit microprocessor and dataway control module. Both blocks having the minimum width are connected by a system bus through the connectors on the front panels. The controller has a serial interface for terminal connection, timer, programmable interrupt controller, 16-bit ports for dataway access, RAM and EPROM. memory size depends on a type of a memory microcircuits installed. It may be up to 64 K bytes of EPROM, and up to 952 K bytes of RAM. 1 ref.; 3 figs.; 8 tabs.

57401 **(JINR-R—10-87-827) CAMAC fast units. Issue 2.** Borejko, V.F.; Valuev, Yu.M.; Grebenyuk, V.M.; Zinov, V.G.; Kozhevnikov, Yu.A.; Rudenko, A.I.; Selikov, A.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1987. 18p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704395/JAW.

9 new blocks are briefly described. They are designed mainly for construction of trigger systems and time-of-flight spectrometers. Besides, some blocks can be used to test and calibrate the electronic equipment for automated workstation. Technical characteristics of the blocks are given. Most of the blocks are in quantity production in the JINR experimental workshop. 3 refs.; 17 figs.

57402 **(JINR-R—11-87-839) Software for remote task control in SONET-2 local area network.** Alfimenkov, A.V.; Khrykina, T.D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1987. 11p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704397/JAW.

Software realising the access for terminal of central net computer to task working on a remote computer through LAN SONET-2 is described. The method of switching terminal input/output of task working on remote computer to transport subset of network is considered. The logical structure of remote control channel and items of its software support are described. File transfer subroutine implementation to task working on remote computer and software supporting this transfer on central network computer are described. 3 refs.; 3 figs.

57403 **(LA-UR—88-3278) High-power microwave source development at Los Alamos.** Fazio, M.V.; Kinross-Wright, J.; Hoeberling, R.F.; VanHaaften, F. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 4p. (CONF-881049—11). NTIS, PC A02/MF A01. Order Number DE89000327/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

Experimental research is under way at Los Alamos to develop the large-orbit gyrotron and the resonant-cavity virtual cathode oscillator as very high power microwave sources. These sources, though still in an early stage of development, have demonstrated power outputs from the several hundred megawatt to the gigawatt level at various Laboratories. These devices exhibit very narrow band output, making them candidates for future accelerator drivers. Our efforts are directed toward achieving repetitively pulsed operation at pulse lengths in the microsecond regime. To provide the pulsed power for these experiments, a 1-MV, 10-kA modulator with a 1-μs pulse length and a 5-Hz pulse-repetition frequency has been developed and is currently being assembled. The resonant-cavity virtual cathode source has achieved very narrow band output compared to the conventional free-running virtual cathode oscillator. Techniques are being developed for extracting the microwave power from both sources into the rectangular waveguide. The experimental effort is described and current experimental results are discussed.

57404 **(PB—88-242060/XAB) Automated high-temperature guarded-hot-plate apparatus for measuring apparent thermal conductivity.** Hust, J.G.; Filla, B.J.; Hurley, J.A.; Smith, D.R. (National Bureau of Standards, Boulder, CO (USA). Chemical Engineering Science Div.). May 1988. 132p. (NBSIR—88/3089). NTIS, PC A07/MF A01.

An automated guarded-hot-plate apparatus was designed and built to meet the requirements of ASTM Standard Test Method C-177 for measuring the thermal conductance of thermal insulation. Apparent thermal conductivity was measured with this apparatus in the range from 40 to 100 mW/(m.K) at mean temperatures from 300 to 750 K, in environments of air and helium, at pressures ranging from atmospheric pressure to roughing-pump vacuum. The apparatus is controlled by a desk-top computer. A thermocouple device of novel design more accurately senses the average temperature over the surface of each heater plate. An improved algorithm for the control sequence leads to more-stable heater powers and specimen temperatures. Overall uncertainties of apparent thermal conductivities at atmospheric pressure are 2% at 300 K and 5% at 750 K when measuring conductivities in the range from 40 to 100 mW/(m.K). The apparatus will be valuable in development of new Standard Reference Materials of low conductivity and for higher-temperature ranges, and is being used in comparative interlaboratory measurement programs.

57405 **(PB—88-867841/XAB) Magnetometers. January 1970-August 1988 (Citations from the US Patent data base). Report for January 1970-August 1988.** (National Technical Information Service, Springfield, VA (USA)). Aug 1988. 112p. NTIS PC N01/MF N01.

Supersedes PB—87-863692.

This bibliography contains citations of selected patents concerning magnetometer devices and equipment used in detection, control, and survey systems. The design, fabrication, and application of magnetometers utilizing thin-film, optical, nuclear, and electron-beam technologies are discussed. Applications include navigation systems, vehicle direction control, and natural resource exploration. (This updated bibliography contains 245 citations, 21 of which are new entries to the previous edition.)

57406 **(SAND—88-1760C) State of the research works on PVDF piezoelectric polymer stress gauges.** Bauer, F.; Graman, R.A.; Lee, L.M.; Samara, G. (Sandia National Labs., Albuquerque, NM (USA); Institut Franco-Allemand de Recherches de Saint-Louis, 68 (France)). 1988. Contract AC04-76DP00789. 5p. (CONF-880940—3). NTIS, PC A02/MF A01. Order Number DE88017114/JAW.

From 2. international conference on mechanical and physical behavior of materials under dynamic loading; Ajaccio, France (19 Sep 1988).

The research work presented here shows the progress realized in the studies of the ferroelectric and piezoelectric properties of Polyvinylidene Flouride (PVDF). An attempt has been made to understand the fundamental phenomena of the mechanism responsible for the functioning of the shock loaded ferroelectric PVDF. Fundamental questions have not yet found a sufficient response. The main parameter which must be taken into account in the standardization process, is the polarization which is fixed at a value of 9.15 +- 0.15 $\mu C/cm^2$. There are different PVDF, but it seems clear

that there is only one piezoelectric PVDF which can be used for shock gauge transducers.

57407 **(UCID—21174) The Configurable Seismic Monitoring System (CSMS): Local Seismic Network (LSN) data acquisition user's manual: Version 1.0.** Peterson, S.J.; Zucca, J.J.; Ewert, D.W.; Moccia, D.J.; Rock, D.W.; Stager, R.K. (Lawrence Livermore National Lab., CA (USA)). 1 Sep 1988. Contract W-7405-ENG-48. 38p. NTIS, PC A03/MF A01. Order Number DE89000663/JAW.

The Configurable Seismic Monitoring System (CSMS) is a portable seismograph system that can be used for a variety of applications. In its primary format, the CSMS is the Local Seismic Network (LSN); however, the CSMS could be used for site surveys in advance of installing permanent single stations and arrays. It could also be used for special experiments requiring portable recording equipment. 4 figs.

57408 **(UCID—21458) Fundamental limitations and trade-offs for high power microwave generation with photoconductors.** Pocha, M.D. (Lawrence Livermore National Lab., CA (USA)). 25 Apr 1988. Contract W-7405-ENG-48. 19p. NTIS, PC A03/MF A01. Order Number DE89001468/JAW.

There has recently been much interest in photoconductive devices as high speed, low jitter, high power switches for use in high power microwave generation systems. While photoconductive switches are very promising devices there are some fundamental limits and trade-offs which must be considered in attempting to apply them to high power microwave generation. The purpose of this report is to describe the more important of these fundamental limits and trade-offs and to present some criteria for comparison of various circuit and system approaches. 1 ref.

57409 **(UCID—21493) Source near-field effects on HPM coupling.** King, R.J.; Hudson, H.G. (Lawrence Livermore National Lab., CA (USA)). Aug 1988. Contract W-7405-ENG-48. 54p. NTIS, PC A04/MF A01. Order Number DE89001552/JAW.

This report gives an overview of many of these issues and cites examples. It is part of an on-going effort to investigate all aspects of the phenomenology of HPM interactions with systems. Experimental results are given for near-field coupling into generic test systems. While we do not exhaustively answer all of these questions, certain trends are observed. From these, some general conclusions are drawn to guide the use of HPM simulators for testing full systems. 3 refs., 43 figs., 2 tabs.

57410 **(UCRL—98248) Sputtered-sliced multilayers: Zone plates and transmission gratings for 8-keV x rays.** Bionta, R.M.; Ables, E.; Cook, K.J.; Edwards, O.D.; Gabriele, P.C.; Jankowski, A.F.; Makowiecki, D.M.; Ott, L.L.; Thomas, N. (Lawrence Livermore National Lab., CA (USA)). 29 Jul 1988. Contract W-7405-ENG-48. 7p. (CONF-880887—20). NTIS, PC A02/MF A01. Order Number DE88016285/JAW.

From 32. international technical symposium on optical and opto-electronic applied sciences and engineering; San Diego, CA, USA (14 Aug 1988).

We have made and tested several sliced multilayer structures that can function as transmissive x-ray optical elements (diffraction gratings, zone plates and phase gratings) at 8-keV. Both amplitude-modulating and phase-modulating devices have been produced. We show data taken in the beam of a 8 keV x-ray source that demonstrate diffraction and focusing. The diffraction patterns produced by the multilayer devices closely match theoretical predictions. Such transmissive optics have the potential for a wide application to high-resolution microscope and spectrometer systems. 6 refs., 15 figs.

57411 **(UCRL—98255) Manufacture, structure and performance of W/B_4C multilayer x-ray mirrors.** Jankowski, A.F.; Makowiecki, D.M. (Lawrence Livermore National Lab., CA (USA)). Jun 1988. Contract W-7405-ENG-48. 14p. (CONF-880887—25). NTIS, PC A03/MF A01. Order Number DE89001503/JAW.

From 32. international technical symposium on optical and opto-electronic applied sciences and engineering; San Diego, CA, USA (14 Aug 1988).

One of the most important considerations in the design and manufacture of multilayer mirrors is material compatibility. Ideally, the materials selected should not chemically react or interdiffuse thereby avoiding the formation of second phases, enhancing the smoothness of the deposited layer interface and hence enhancing the reflectivity of the optic. It is also possible to increase the reflectivity by decreasing the thickness of the more absorbing layers and increasing the thickness of the less absorbing layers, for any given periodicity. The optimum thickness of each layer, however, is rigorously related to the specific materials as well as the x-ray wavelength being used. The transparency of the spacing (low absorption) layers can thus be augmented by materials of low absorption that are thermodynamically stable and which deposit in a smooth continuous fashion. Whereas the use of boron as opposed to carbon as a spacing material provides lower absorption, it is typically inferior in providing as low as interfacial roughness in multilayer form. For example, in rhenium-tungsten/carbon multilayers, produced by evaporation, a typical roughness of <0.3 nm is obtained versus 0.7 nm for rhenium-tungsten/boron multilayers. Our initial findings with B_4C layers indicate deposits which show layer smoothness exceeding those containing carbon with the advantage of greater stability, lower absorption and therefore greater reflectivity. The manufacture, microstructure and reflectivity of W/B_4C multilayers will be the focus of this presentation. 11 refs., 7 figs., 1 tab.

57412 **(UCRL—98415) Performance evaluation of the Kentech optical streak camera.** Bonlie, J.D. (Lawrence Livermore National Lab., CA (USA)). 10 Jul 1988. Contract W-7405-ENG-48. 14p. (CONF-8809105—5). NTIS, PC A03/MF A01. Order Number DE88017008/JAW.

From SPIE O-E Lase: international symposium and exhibition on fiber optics, optoelectronics and laser applications; Boston, MA, USA (6 Sep 1988).

We have qualitatively tested four prototype streak cameras designed and built by Kentech Instruments, Ltd. of London. The unique design of each camera incorporates an intensified image tube and all of the supporting electronics into a small package. This paper presents test data obtained to date; the state-of-the-art measurement techniques used; the test results, which graphically demonstrate photocathode sensitivity, useful dynamic range, static and dynamic fidelity, and gating-extinction ratio; and other information. 3 refs., 13 figs.

57413 **(UCRL—98433) Veiling glare in the ITT F4113 image intensifier.** Wiedwald, J.D.; Hertel, R.J. (Lawrence Livermore National Lab., CA (USA); ITT Corp., Fort Wayne, IN (USA). Electro-Optics Products Div.). Aug 1988. Contract W-7405-ENG-48. 8p. (CONF-880887—21). NTIS, PC A02/MF A01. Order Number DE89001242/JAW.

From 32. international technical symposium on optical and opto-electronic applied sciences and engineering; San Diego, CA, USA (14 Aug 1988).

Users of the ITT F4113 proximity-focused image intensifier tube have generally been unable to obtain its specified resolution when using it to amplify streak tube images. As well as reduced high-frequency resolution, some output light can be detected at distances as great as a few millimeters from the input image. This long-range light spreading is called veiling glare. In this paper we present measurements and propose the cause of the F4113's veiling glare. The most probable cause is electron scattering at the front surface of the microchannel plate, with some contribution due to electron scattering at the phosphor. The cause of reduced resolution at higher spatial frequencies is also discussed. This is most likely due to the combined effects of phosphor thickness, photographic film thickness and the high numerical aperture of the fiber optics. Finally, some improvements have recently been made to the F4113. These are described and possible additional improvements are suggested. 7 refs., 7 figs.

57414 **(UCRL—99457) Use of laser diodes for analog fiber optic diagnostics systems.** Hagans, K.G.; Haigh, R.E.; Francis, H.D. (Lawrence Livermore National Lab., CA (USA)). 22 Aug 1988. Contract W-7405-ENG-48. 6p. (CONF-8809105—4). NTIS, PC A02/MF A01. Order Number DE88017012/JAW.

From SPIE O-E Lase: international symposium and exhibition on fiber optics, optoelectronics and laser applications; Boston, MA, USA (6 Sep 1988).

Because the time resolution requirements of experiments at the Nevada Test Site exceed the capabilities of traditional electrical analog cable, fiber optic analog diagnostics systems have become attractive. A number of different instrumentation systems are possible using commercially available laser-diode transmitters. In addition, the fiber optic systems designer has a choice of receivers, operating wavelengths, and fiber types. We will compare the system performance of 810-nm systems with both single-mode and multimodel fiber as well as 1300-nm single-mode fiber systems with both a photodiode oscilloscope and a laser-diode streak-camera receiver. 3 figs., 1 tab.

57415 **(UCRL—99460) The development of a high bandwidth 1300 nm recording system.** Haigh, R.E.; Hagans, K.G. (Lawrence Livermore National Lab., CA (USA)). 29 Aug 1988. Contract W-7405-ENG-48. 5p. (CONF-8809105—6). NTIS, PC A02/MF A01. Order Number DE88017017/JAW.

From SPIE O-E Lase: international symposium and exhibition on fiber optics, optoelectronics and laser applications; Boston, MA, USA (6 Sep 1988).

A 3-GHz bandwidth fiber optic analog transmission system has been prototyped using directly modulated 1.3-μm InGaAsP semiconductor laser diodes. The low loss dispersion-free window in singlemode fiber at 1.3 μm allows the signal to be transmitted almost ideally. A high bandwidth photodiode/amplifier pair converts the signal back to an electrical form where it is recorded on a 6-GHz transient digital oscilloscope. 2 refs., 6 figs.

57416 **(UCRL—99533) Ultrafast framing of x-ray images.** Stearns, D.G.; Wiedwald, J.D.; Cook, B.M.; Hanks, R.L.; Landen, O.L. (Lawrence Livermore National Lab., CA (USA)). 1988. Contract W-7405-ENG-48. 10p. (CONF-880887—23). NTIS, PC A02/MF A01. Order Number DE89001289/JAW.

From 32. international technical symposium on optical and opto-electronic applied sciences and engineering; San Diego, CA, USA (14 Aug 1988).

The interaction pulsed, high-intensity ($I > 10^{14} W/cm^2$) laser light with a solid target typically produces a dense plasma that radiates significantly in the soft x-ray region of 0.1-10 keV. Important information concerning the dynamics of the laser-produced plasmas can be obtained through time-resolved imaging and spectroscopy of the x-ray emission. In particular, high-resolution x-ray imaging provides a direct means of studying the evolution of temperature and density profiles of the plasma, as well as the hydrodynamics which govern its expansion. Since the expansion velocities can be in excess of 10^7 cm/s, the frame duration of the time-resolved image must be less than 100 ps to avoid significant blurring. In addition, the laser-produced plasmas are usually small and have large density gradients, particularly at early times. Consequently, it is desirable that the imaging system be able to resolve structure on a spatial scale of {approximately}1-10 μm. In this paper we describe the development of a high resolution x-ray framing camera (XFC) to be used to image the soft x-ray emission from laser-produced plasmas on a picosecond timescale. The XFC generates a single frame with 50 ps temporal resolution 22μm spatial resolution at the image plane and real time readout. The camera is optically triggered, resulting in jitter-free synchronization of the frame time with the laser experiment, making it possible to integrate multiple shots with no loss of temporal resolution. One of the first applications of the XFC will be to image the dynamic implosion of micro-balloon fuel pellets for laser fusion using the Nova 10-beam laser system. 5 refs., 5 figs., 1 tab.

57417 **High-temperature and -pressure system for laser Raman spectroscopy of aqueous solutions.** Marley, N.A.; Ott, M.; Fearey, B.L.; Benjamin, T.M.; Rogers, P.S.Z.; Gaffney, J.S. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Review of Scientific Instruments;* 59: No. 10, 2247-2253(Oct 1988).

A high-temperature, high-pressure experimental system is presented that is compatible with a state-of-the-art laser Raman spectrometer. The apparatus and associate electronics and valving, which allow Raman spectra acquisition from ambient conditions to 500 °C and 1-kbar pressure in corrosive aqueous solutions, are described. Diamond windows and a titanium bodied optical design are used to obtain these conditions. Automatically controlled heating jackets have been built that allow +- 0.4 °C temperature stability over this range. Raman spectra are presented that demonstrate the capabilities of this experimental apparatus for aqueous studies as a function of temperature and pressures.

57418 **Ionization monitor with improved ultra-high megohm resistor.** Burgess, E.T. (to Dept. of Energy, Washington, DC). US Patent 4,755,682. 5 Jul 1988. Filed date 7 Oct 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

An ionization monitor is described including: a counter chamber including electrically conductive wall means for containing an ionizable gas and an electrically conductive counting electrode extending through and electrically insulated from the wall means; whereby radiation-induced ionization of gas in the chamber causes electron flow between the counting electrode and the wall means proportional to the amount of radiation; an electrometer circuit having a high-impedance input directly connected to the counting electrode means, a low-impedance output, and 100% negative feedback means connected between the output and the input, the feedback means consisting of a high-impedance resistor having one end directly connected to the electrometer input and an other end connected to the output.

57419 **Tunable resonant sensing means to sense a particular frequency in a high energy charged particle beam and generate a frequency-domain signal in response.** Nakamura, M.; Nolan, M.L. (to Dept. of Energy, Washington, DC). US Patent 4,752,728. 21 Jun 1988. Filed date 22 Sep 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A frequency domain sensing system is described for sensing the position of a high energy beam of charged particles traveling within a housing which comprises sensings means positioned on the housing radially around the axis of the beam, each of the sensing means further comprising a first electrode means of predetermined shape and spacing from the housing to define a fixed capacitance, inductance means attached to the electrode to provide an inductance for the sensing means which will provide LC circuit which will resonate at a predetermined frequency known to exist in the beam of charged particles, and means carried by the sensing means to vary the amount of the inductance to tune the sensing means to the predetermined frequency.

57420 **Optical ranked-order filtering using threshold decomposition.** Allebach, J.P.; Ochoa, E.; Sweeney, D.W. US Patent Application 6-106,295. 9 Oct 1987. 27p. Contract AC04-76DP00789. NTIS, PC A03/MF A01.

A hybrid optical/electronic system performs median filtering and related ranked-order operations using threshold decomposition to encode the image. Threshold decomposition transforms the nonlinear neighborhood ranking operation into a linear space-invariant filtering step followed by a point-to-point threshold comparison step. Spatial multiplexing allows parallel processing of all the threshold components as well as recombination by a second linear, space-invariant filtering step. An incoherent optical correlation system performs the linear filtering, using a magneto-optic spatial light modulator as the input device and a computer-generated hologram in the filter plane. Thresholding is done electronically. By adjusting the value of the threshold, the same architecture is used to perform median, minimum, and maximum filtering of images. A totally optical system is also disclosed. 3 figs.

57421 **Single molecule tracking.** Shera, E.B. US Patent Application 6-105,376. 7 Oct 1987. 14p. Contract W-7405-ENG-36. NTIS, PC A03/MF A01.

A detection system is provided for identifying individual particles or molecules having characteristic emission in a flow train of the particles in a flow cell. A position sensitive sensor is located adjacent the flow cell in a position effective to detect the emissions from the particles within the flow cell and to assign spatial and temporal coordinates for the detected emissions. A computer is then enabled to predict spatial and temporal coordinates for the particle in the flow train as a function of a first detected emission. Comparison hardware or software then compares subsequent detected spatial and temporal coordinates with the predicted spatial and temporal coordinates to determine whether subsequently detected emissions originate from a particle in the train of particles. In one embodiment, the particles include fluorescent dyes which are excited to fluoresce a spectrum characteristic of the particular particle. Photons are emitted adjacent at least one microchannel plate sensor to enable spatial and temporal coordinates to be assigned. The effect of comparing detected coordinates with predicted coordinates is to define a moving sample volume which effectively precludes the effects of background emissions. 3 figs.

57422 **Wall thickness measuring method and apparatus.** Salzer, L.J.; Bergren, D.A. US Patent Application 6-105,154. 6 Oct 1987. 15p. Contract W-7405-ENG-36. NTIS, PC A03/MF A01.

An apparatus for measuring the wall thickness of a nonmagnetic article having a housing supporting a magnet and a contiguous supporting surface. The tubular article and the housing are releasably secured to the supporting surface and a support member of an optical comparator, respectively. To determine the wall thickness of the article at a selected point, a magnetically responsive ball is positioned within the tubular article over said point and retained therein by means of a magnetic field produced by the magnet. Thereafter, an optical comparator is employed to project a magnified image of the ball on a screen and the wall thickness at the selected point is calculated by using a ball surface measurement taken with the comparator in conjunction with a previously determined base line measurement.

57423 **Aplanatic and quasi-aplanatic diffraction gratings.** Hettrick, M.C. US Patent Application 6-095,715. 14 Sep 1987. 'p. Contract AC03-76SF00098. NTIS, PC A03/MF A01.

A reflection diffraction grating having a series of transverse minute grooves of progressively varying spacing along a concave surface enables use of such gratings for x-ray or longer wavelength imaging of objects. The variable groove spacing establishes aplanatism or substantially uniform magnetification across the optical aperture. The grating may be sued, for example, in x-ray microscopes or telescopes of the imaging type and in x-ray microprobed. Increased spatial resolution and field of view may be realized in x-ray imaging. 5 figs.

57424 **Magnetically insulated transmission line oscillator.** Bacon, L.D.; Ballard, W.P.; Clark, M.C.; Marder, B.M. US Patent Application 6-051,562. 19 May 1987. 35p. Contract AC04-76DP00789. NTIS, PC A03/MF A01.

A magnetically insulated transmission line oscillator employs self-generated magnetic fields to generate microwave energy. An anode of the oscillator includes slow-wave structures which are formed of a plurality of thin conductive vanes defining cavities therebetween, and a gap is formed between the anode and a cathode of the oscillator. In response to a pulsed voltage applied to the anode and cathode, self-generated magnetic fields are produced in a cross-field orientation with respect to the orientation of the electric field between the anode and the cathode. The cross-field magnetic fields insulate the flow of electrons in the gap and confine the flow of electrons within the gap. 11 figs.

57425 **Microwave generator.** Kwan, T.J.T.; Snell, C.M. US Patent Application 6-032,262. 31 Mar 1987. 17p. Contract W-7405-ENG-36. NTIS, PC A03/MF A01.

A microwave generator is provided for generating microwaves substantially from virtual cathode oscillation. Electrons are emitted from a cathode and accelerated to an anode which is spaced apart from the cathode. The anode has an annular slit there through effective to form the virtual cathode. The anode is at least one range thickness relative to electrons reflecting from the virtual cathode. A magnet is provided to produce an optimum magnetic field having the field strength effective to form an annular beam from the emitted electrons in substantial alignment with the annular anode slit. The magnetic field, however, does permit the reflected electrons to axially diverge from the annular beam. The reflected electrons are absorbed by the anode in returning to the real cathode, such that substantially nc reflexing electrons occur. The resulting microwaves are produced with a single dominant mode and are substantially monochromatic relative to conventional virtual cathode microwave generators. 6 figs.

57426 **Motion detector and analyzer.** Unruh, W.P. US Patent Application 6-029,033. 23 Mar 1987. 22p. Contract W-7405-ENG-36. NTIS, PC A03/MF A01.

Method and apparatus are provided for deriving positive and negative Doppler spectrum to enable analysis of objects in motion, and particularly, objects having rotary motion. First and second returned radar signals are mixed with internal signals to obtain an in-phase process signal and a quadrature process signal. A broad-band phase shifter shifts the quadrature signal through 90{degree} relative to the in-phase signal over a predetermined frequency range. A pair of signals is output from the broad-band phase shifter which are then combined to provide a first side band signal which is functionally related to a negative Doppler shift spectrum. The distinct positive and negative Doppler spectra may then be analyzed for the motion characteristics of the object being examined.

57427 **Compact range for variable-zone measurements.** Burnside, W.D.; Rudduck, R.C.; Yu, J.S. US Patent Application 6-019,836. 27 Feb 1987. 13p. Contract AC04-76DP00789. NTIS, PC A03/MF A01.

A compact range for testing antennas or radar targets includes a source for directing energy along a feedline toward a parabolic reflector. The reflected wave is a spherical wave with a radius dependent on the distance of the source from the focal point of the reflector. 2 figs.

57428 **Optical techniques for sensing and measurement in hostile environments; Proceedings of the Meeting, Orlando, FL, May 21, 22, 1987.** Gillespie, C.H.; Greenwell, R.A. Bellingham, WA; Society of Photo-Optical Instrumentation Engineers (1987). 161p. (CONF-8705231—).

From Optical techniques for sensing and measurement in hostile environments; Orlando, FL, USA (21 May 1987).

Papers are presented on referencing in fiber optic sensing systems, optical fiber chemical sensing networks, and the radiation response of new pure silica fibers. Also considered are a comparison of gamma, neutron, and proton irradiations of multimode fibers, a pinhole camera for hot environment viewing of electron beam materials processing, and the utilization of optical image data from the advanced test accelerator. Other topics include the application of an interferometer spectrometer aboard the Space Shuttle with a payload specialist in the control loop, hydrogen chloride measurements in launch-vehicle exhaust clouds, and a rocket-borne telescoped Fourier transform spectrometer operating at 10 K.

57429 **(LA-tr—88-1) Synchronization of pulsed magnetrons.** Jokanovic, Branka. Translated from *Naucno-Tehnicki Pregled ;* **34**: No. 10, 32-38(1984). Contract W-7405-ENG-36. 22p. NTIS, PC A03/MF A01. Order Number DE89001024/JAW.

As a non-coherent pulse oscillator, a magnetron has limited application in modern radar equipment by comparison with other microwave sources. Synchronization by means of an externally applied sinusoidal signal with low power leads to increases in the frequency stability of the magnetron, rate of ascent in the front edge, and drastically reduces front edge jitter. This allows the magnetron to become of interest again as a radar transmitter, even in those applications where it needs to operate with extremely narrow pulses of up to 50 nanoseconds. The basic parameters were also analyzed

that affect magnetron synchronization, as well as the most interesting effects of synchronization. 8 refs., 12 figs.

4404 Well Logging Instrumentation

REFER ALSO TO CITATION(S) 56237, 56274, 56334, 57084, 57487, 57488, 57489, 57490, 57491, 57633

57430 (IAEA-TECDOC—464) Current trends in nuclear borehole logging techniques for elemental analysis. Proceedings of a consultants' meeting held in Ottawa, Canada, 2-6 November 1987. (International Atomic Energy Agency, Vienna (Austria)). Jun 1988. 155p. (CONF-8711234—). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704190/JAW.

From Consultants' meeting on current trends in nuclear borehole logging techniques for elemental analysis; Ottawa, Canada (2 Nov 1987).

This report is the result of a consultants' meeting organized by the IAEA and held in Ottawa, Canada, 2-6 November 1987 in order to assess the present technical status of nuclear borehole logging techniques, to find out the well established applications and the development trends. It contains a summary report giving a comprehensive overview of the techniques and applications and a collection of research papers describing work done in industrial institutes. A separate abstract was prepared for each of these 9 papers. Refs, figs and tabs.

57431 (RF/PRC/T—2/87) Deviated reference well for evaluation of survey equipment. Halsey, G.W. (Rogalandsforskning, Stavanger (Norway)). Jan 1987. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88754874/JAW.

The report deals with a method for the evaluation of survey equipment. A 2000 meter deviated well is available for testing of survey equipment. Reference survey data have been recorded by use of the computer program FINDS. The report describes how survey data will be compared with the reference data.

57432 (WHC-SA—0229) Computer determination of calibration and environmental corrections for a natural spectral gamma-ray logging system. Koizumi, C. (Westinghouse Hanford Co., Richland, WA (USA); Gearhart Industries, Inc., Fort Worth, TX (USA)). Feb 1988. Contract AC06-87RL10930. 26p. NTIS, PC A03/MF A01. Order Number DE89000476/JAW.

Pulse height spectra recorded by a passive spectral gamma-ray logging system were simulated by radiation transport calculations for several combinations of gamma-ray sources and tool environments. Derived from the calculated log responses were (1) source- and energy-dependent environmental corrections, and (2) calibration factors and an environmental correction method for 3-window potassium-uranium-thorium analysis. 6 refs., 9 figs., 3 tabs.

57433 Downhole pulse radar. Chang, Hsi-Tien. US Patent Application 6-101,536. 28 Sep 1987. 21p. Contract AC04-76DP00789. NTIS, PC A03/MF A01.

A borehole logging tool generates a fast rise-time, short duration, high peak-power radar pulse having broad energy distribution between 30 MHz and 300 MHz through a directional transmitting and receiving antennas having barium titanate in the electromagnetically active region to reduce the wavelength to within an order of magnitude of the diameter of the antenna. Radar returns from geological discontinuities are sampled for transmission uphole. 7 figs.

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

REFER ALSO TO CITATION(S) 57182, 57245

57434 (ORNL—6478) Assessment of technical viability of eliminating alcohol in the shipment of bulk RDX/HMX: Final report. Pal, B.C.; Gove, R.M. (Oak Ridge National Lab., TN (USA)). 3 Oct 1988. Contract AC05-84OR21400. 157p. NTIS, PC A08/MF A01. Order Number DE89001350/JAW.

It is customary in the US to add isopropyl alcohol to the bulk shipment of water-wet high explosives RDX and HMX. The explosives are packed in cloth bags which are placed in plastic-lined drums. The addition of alcohol presumably prevents mildewing of cloth bags and freezing of the wet explosives in cold weather. In Europe, however, these explosives are shipped in polyethylene-lined fiber drums with not less that 15% water only, even in cold weather, following the United Nations recommendations. Water-wet frozen RDX has not proved to be any more sensitive than its unfrozen counterpart and no mildew problem has been encountered. It looks promising that the US Department of Transportation regulations can be changed to permit the bulk shipment of these explosives in water only without the addition of isopropyl alcohol. The anticipated benefits are annual peacetime packaging cost saving of $323,900 ($107,400 from alcohol elimination and $216,500 from replacement of cloth bags by polyethylene bags) and elimination of the environmental impact of the release of isopropyl alcohol at the consumer end. (58 refs., 9 figs., 10 tabs.)

57435 (SAND—88-1790) Optimized conical shaped charge design using the SCAP [Shaped Charge Analysis Program] code. Vigil, M.G. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1988. Contract AC04-76DP00789. 87p. NTIS, PC A05/MF A01. Order Number DE89001037/JAW.

The Shaped Charge Analysis Program (SCAP) is used to analytically model and optimize the design of Conical Shaped Charges (CSC). A variety of existing CSCs are initially modeled with the SCAP code and the predicted jet tip velocities, jet penetrations, and optimum standoffs are compared to previously published experimental results. The CSCs vary in size from 0.69 inch (1.75 cm) to 9.125 inch (23.18 cm) conical liner inside diameter. Two liner materials (copper and steel) and several explosives (Octol, Comp B, PBX-9501) are included in the CSCs modeled. The target material was mild steel. A parametric study was conducted using the SCAP code to obtain the optimum design for a 3.86 inch (9.8 cm) CSC. The variables optimized in this study included the CSC apex angle, conical liner thickness, explosive height, optimum standoff, tamper/confinement thickness, and explosive width. The non-dimensionalized jet penetration to diameter ratio versus the above parameters are graphically presented. 12 refs., 10 figs., 7 tabs.

57436 (UCRL—21119) Background estimates for the MIDEP [Mine Detection with Energetic Photons] concept. Miller, R.B.; McCullough, W.F.; Billman, K.; Bowen, C. (Lawrence Livermore National Lab., CA (USA); Titan Technologies, Albuquerque, NM (USA). Spectron Div.). 20 May 1988. Contract W-7405-ENG-48. 81p. (SDL-R—0024). NTIS, PC A05/MF A01. Order Number DE89001527/JAW.

A new technique has been proposed recently for detecting buried, non-metallic mines in the tactical battlefield. The basic feasibility of this nuclear detection technique, named MIDEP, has been previously demonstrated in a small-scale, proof-of-principle experiment conducted at Lawrence Livermore National Laboratory. Nonetheless, because of the importance of obtaining a good S/N ratio with a minimum energy expenditure, it was essential to develop better background source estimates. In this document we report the results of numerical simulations and analyses of the anticipated background sources, and compare them with estimates of the signal strength from the mine itself. Specifically, we have used Monte

Carlo techniques to simulate bremsstrahlung generation as a function of electron energy. Monte Carlo techniques were also used to analyze the penetration of the bremsstrahlung into the ground, in order to develop estimates of the source strengths of both the mine and the background. Analytical techniques were then used to estimate the resulting photon decay count rates as measured by a representative detector geometry. 7 refs., 29 figs.

57437 **(UCRL—53872) Optical magnification correction in dynamic size measurements from refraction at conical shock fronts.** Goosman, D.R. (Lawrence Livermore National Lab., CA (USA)). 20 Sep 1988. Contract W-7405-ENG-48. 12p. NTIS, PC A03/MF A01. Order Number DE89001286/JAW.

An analytical formula is derived for the magnification error in optical size measurements of objects inside conically shaped shock fronts. End detonation of a cylindrically shaped explosive immersed in a fluid necessitates a correction due to refraction at the interface between the shocked and unshocked fluids. It is shown that for detonations immersed in a liquid such as water, the correction factor derived for a conical shock front is significantly larger than the simple correction factor derived if the shock front is assumed to be cylindrical. 2 refs., 5 figs.

57438 **(UCRL—99580) Computer simulations of dynamic compaction experiments.** Wilkins, M.L. (Lawrence Livermore National Lab., CA (USA)). Sep 1988. Contract W-7405-ENG-48. 13p. (CONF-881060—2). NTIS, PC A03/MF A01. Order Number DE89001220/JAW.

From HERAPS '88: international seminar on high energy working of rapidly solidified materials; Novosibirsk, USSR (10 Oct 1988).

Computer simulations of experimental geometries for consolidating powders in cylindrical geometry are presented. Stress wave profiles and velocity fields are calculated. The effects of geometry on rarefactions are discussed. 16 figs.

4502 Nuclear

REFER ALSO TO CITATION(S) 57209

57439 **(AD-A—194873/6/XAB) Direct determination of range from current nuclear overpressure equations. Master's thesis.** Wolczek, R.S. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Mar 1988. 120p. (AFIT/GST/ENP—88M-2). NTIS, PC A06/MF A01.

The Brode expression determines peak overpressure as a function of scaled ground range from ground zero and scaled height of burst for nuclear explosions occurring at low altitudes. This study developed analytical expressions to directly compute scaled ground range from ground zero as a function of peak overpressure and scaled height of burst for a nuclear explosion. Since the Brode expression was an empirical fit of actual and predicted data, a curve-fitting approach was selected over attempting to mathematically invert the expression. The Brode expression was used to both generate the data and evaluate the quality of any new expression. Acceptable error was specified as 10% of the actual ground range for those regions of interest. Five analytical expressions in the form of polynomial equations were developed spanning peak overpressures from 1 to 100,000 psi. These polynomial equations were then combined into a Fortran 77 computer program which generated ground range directly from inputs of weapon yield, peak overpressure, and weapon burst height. In most cases the error of the new approximation was well below ten percent of the actual ground range.

57440 **(AD-A—195074/0/XAB) Source Region Electromagnetic Effects Phenomena. Volume 5. Analytic solutions for SREMP (Source Region Electromagnetic Pulse) environments. Technical report, 1 May 1985-30 March 1986.** Van Alstine, P.W.; Schlessinger, L. (Pacific-Sierra Research Corp., Los Angeles, CA (USA)). 25 Apr 1986. 53p. (PSR—1588-VOL-5). NTIS, PC A04/MF A01.

See also Volume 1, AD-B110 183L.

Three-dimensional integral equations and integral solutions were derived for the fields generated by a Compton current distribution with arbitrary time and space variations in the presence of conducting air and ground with arbitrary time variations in conductivity. Here they are solved analytically for a number of important SREMP cases that include (1) arbitrary three-dimensional currents in the presence of infinitely conductive ground, (2) equal air and ground conductivities, and (3) arbitrary one-dimensional (height-dependent) currents when the ground conductivity is a constant multiple of the (time-dependent) air conductivity. Particular realistic forms for the Compton current are used to explicitly evaluate the solutions to find the SREMP fields produced by them.

57441 **(AD-A—195351/2/XAB) ISST (Intercontinental Ballistic Missile Silo Superhardening Technology) structure with SIFCON (Slurry-Infiltrated Fiber Concrete) - HFC-2 test. Final report, November 1983-September 1984.** Schneider, B.; Mondragon, R.; Kirst, J.; Berglund, J. (New Mexico Engineering Research Inst., Albuquerque (USA)). Apr 1988. 380p. (NMERI-WA—8-25-(8.16)). NTIS, PC A17/MF A01.

In 1983 a new material, slurry-infiltrated fiber concrete (SIFCON), was brought to the attention of the Air Force Weapons Laboratory (AFWL) by Dr David Lankard of the Lankard Materials Laboratory (LML) in Columbus, Ohio. A review of both high strength and ductility indicated that the material had a potential use in a superhard silo structure. Because the material showed such promise, AFWL proposed a program to construct and test a scale model of a generic superhard silo structure using the SIFCON material. AFWL decided to place the structure in a scheduled calibration test that was part of the Intercontinental Ballistic Missile Silo Superhardening Technology (ISST) testing program in Yuma, Arizona. NMERI then began a program to develop a slurry mix design for use in the structure, as well as construction techniques for placing the SIFCON in the wall of the model.

57442 **(AD-A—195404/9/XAB) Analysis of radiation exposure for military participants. Exercises Desert Rock 1, 2, and 3 - Operation Buster-Jangle. Technical report.** Barrett, M.; Goetz, J.; Klemm, J.; Ortlieb, E.; Thomas, C. (Science Applications International Corp., McLean, VA (USA)). 22 Dec 1987. 22p. (SAIC—87/1037). NTIS, PC A03/MF A01.

Radiation doses to observers, maneuver troops, technical projects, and support units for Exercises Desert Rock I, II, and III are reconstructed for each applicable shot of Operation Buster-Jangle (1951). Residual radiation doses are calculated from the characterized radiation environments and the activity scenarios of the participants. Uncertainties are determined from the variances of each parameter used in the calculations. Exposure to initial radiation was negligible, but the 50-year bone dose commitment from exposure to internal emitters was significant for some personnel due to the type and duration of activities in the resuspendible debris from the surface and underground shots (Sugar and Uncle). Calculated mean film-badge equivalent doses for the Desert Rock exercises ranged up to 0.53 rem for observers, 0.08 rem for maneuver troops, and about 3.6 rem for a Desert Rock III engineer (Shot Uncle). Exposure of support units, if personnel had not been rotated, could have led to mean doses ranging to 3.7 rem. Internal doses were as high as 2.9 rem bone-dose commitment for Desert Rock II ordinance and engineer evaluators at Shot Sugar who also returned to the site (in 1952) after the operation for final evaluation of test equipment, and 2.2 rem for engineer recovery and restoration personnel in 1952.

57443 **(UCRL—99260) Support of Product Data Exchange Specification [PDES] by the Department of Energy Nuclear Weapons Complex.** Wapman, P.D. (Lawrence Livermore National Lab., CA (USA)). 25 Jul 1988. Contract W-7405-ENG-48. 8p. (CONF-8810121—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88014169/JAW.

From Autofact '88; Chicago, IL, USA (30 Oct-1988).

The Department of Energy Nuclear Weapons Complex formed the Product Definition Initiative to ensure their product lifecycle needs are represented in the development of the Product Data Exchange Specification (PDES). The PDI project actively

supports the PDES effort by developing, validating, and verifying PDES information models and by contributing application information models of importance to the Nuclear Weapons Complex.

57444 **(UCRL—99307) Priorities for modeling biological processes in climates altered by nuclear war.** Detling, J.K.; Kercher, J.R.; Post, W.M.; Cowles, S.W.; Harwell, M.A. (Lawrence Livermore National Lab., CA (USA)). 1987. Contract W-7405-ENG-48. 15p. (CONF-8710378—1). Q/MF A01. Order Number DE88016169/JAW.

From Ecological effects of nuclear war; Albuquerque, NM, USA (26 Oct 1987).

This document describes research that has been accomplished or currently models the effects of reduced light and temperature on terrestrial systems. We shall divide the systems to be studied into cultivated lands and uncultivated lands. The cultivated class consists of monoculture systems in which the individual plants belong to the same age and size class. The systems in the uncultivated class consist of uneven age, multi-species assemblies of interacting plants and animals. The uncultivated class ranges from minimally managed systems, e.g., rangelands and some forests, to completely unmanaged wildlands. For the cultivated case, the variable of concern is the annual yield of the crop under consideration. The models should be able to estimate percent yield loss as a function of reductions of light and temperature. The models should be accurate for the range of environments predicted for the growing season immediately following or during which the hypothetical nuclear exchange occurs. The models should be able to estimate yield loss in any subsequent year for which climatic conditions still differ significantly from normal. For the uncultivated case, the modelling program needs to be able to predict the effects on individual plants much the same as in the cultivated case; but in addition, the modelling program will have the task of estimating the effect that these changes in individual organisms will have at higher levels of organization, i.e., on populations, communities, and regional distributions of species. 25 refs., 1 tab.

57445 **Identification of nuclear weapons.** Mihalczo, J.T.; King, W.T. US Patent Application 6-036,744. 10 Apr 1987. 25p. Contract AC05-84OR21400. NTIS, PC A03/MF A01.

A method and apparatus for non-invasively indentifying different types of nuclear weapons is disclosed. A neutron generator is placed against the weapon to generate a stream of neutrons causing fissioning within the weapon. A first detects the generation of the neutrons and produces a signal indicative thereof. A second particle detector located on the opposite side of the weapon detects the fission particles and produces signals indicative thereof. The signals are converted into a detected pattern and a computer compares the detected pattern with known patterns of weapons and indicates which known weapon has a substantially similar pattern. Either a time distribution pattern or noise analysis pattern, or both, is used. Gamma-neutron discrimination and a third particle detector for fission particles adjacent the second particle detector are preferably used. The neutrons are generated by either a decay neutron source or a pulled neutron particle accelerator.

4503 Explosion Detection

REFER ALSO TO CITATION(S) 56904, 57635

57446 **(AD-A—194991/6/XAB) Miscellaneous studies in decoupling. Annual report, March 1985-September 1987.** Gupta, I.N.; McLaughlin, K.L.; Wagner, R.A.; McElfresh, T.W.; Marshall, M.E. (Teledyne Geotech, Alexandria, VA (USA). Alexandria Labs.). Nov 1987. 102p. (TGAL—87-4). NTIS, PC A06/MF A01.

Contents include: Analysis of Project Cowboy Strong-Motion Data; Effect of Scaled Depth on Regional Phases; Deconvolution and Spectral Ratios from Soviet Salt Shots; and Deconvolution and Spectral Ratios from Soviet Salt Short; and Analysis of Data from Soviet Salt Shots with Known Yields.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

REFER ALSO TO CITATION(S) 56722, 57625

57447 **(NP—8770415) Protection of the earth atmosphere. A BMFT survey on research activities investigating into selected fields of atmospheric and climatic research - to be submitted to the Enquete Commission.** (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 28 Jan 1988. 42p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88770415/JAW.

The BMFT survey informs about the research activities investigating into the greenhouse effect, climatic impacts, the enrichment of ozone and other trace elements as well as their transport to the troposphere, the degradation of ozone in the stratosphere. The survey discusses the respective problems, present knowledge, data and results of research programs and provides a bibliography on each of the subjects referred to. The report will be submitted to the enquete commission on 'precautions to be taken to protect the earth atmosphere'. (HSCH).

57448 **(PNL—6684) The data collection component of the Hanford Meteorology Monitoring Program.** Glantz, C.S.; Islam, M.M. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 221p. NTIS, PC A10/MF A01. Order Number DE89000404/JAW.

An intensive program of meteorological monitoring is in place at the US Department of Energy's Hanford Site. The Hanford Meteorology Monitoring Program involves the measurement, observation, and storage of various meteorological data; continuous monitoring of regional weather conditions by a staff of professional meteorologists; and around-the-clock forecasting of weather conditions for the Hanford Site. The objective of this report is to document the data collection component of the program. In this report, each meteorological monitoring site is discussed in detail. Each site's location and instrumentation are described and photographs are presented. The methods for processing and communicating data to the Hanford Meteorology Station are also discussed. Finally, the procedures followed to maintain and calibrate these instruments are presented. 2 refs., 83 figs., 15 tabs.

57449 **(UCRL—99436) Sensitivity of urban/regional chemistry to climate change: Report of the workshop.** Wuebbles, D.J.; Penner, J.E. (Lawrence Livermore National Lab., CA (USA)). Jul 1988. Contract W-7405-ENG-48. 116p. (CONF-8802108—Summ). NTIS, PC A06/MF A01. Order Number DE88017029/JAW.

From Sensitivity of urban/regional chemistry to climate change workshop; Chapel Hill, NC, USA (17 Feb 1988).

This report is a summary of a special workshop sponsored by the Environmental Protection Agency concerning the potential impacts of climate change on urban and regional air quality. Attendees at the workshop included representatives from key research groups in the modeling of urban and regional processes, experts in climate and atmospheric chemistry, and EPA technical and administrative staff. A basic finding of the workshop was that only a very limited number of studies on the sensitivity of urban/regional models to climate change currently exist; much more remains to be done. Additional model development and additional laboratory and atmospheric data are needed before the effects of climate change can be fully understood. An action plan for future research was suggested at the workshop.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 56038, 56073, 56380, 56385, 56529, 56720, 56798, 56814, 56821, 57253, 57267, 57447, 57449, 57498, 57572, 57607

57450 **(AD-A—195302/5/XAB) Smoothing spatial data by estimating mean local variance. Technical report.** Johnson, L.D. (Naval Postgraduate School, Monterey, CA (USA)). Apr 1988. 36p. (NPS—55-88-005). NTIS, PC A03/MF A01.

A nearest-neighbor nonparametric regression method is used to estimate air-pollution levels at other than measured points. The method requires an appropriate smoother. Cross-validation is used to determine the appropriate smoother. An alternative method is introduced to determine an appropriate level of smoothing that involves minimizing mean local variance. Mean local variance is a function of the size of a circular window. It is minimized for two pollutants in Ohio, New York, and Florida. The smoother obtained by cross-validation using Ohio's data is compared to that obtained by minimizing mean local variance.

57451 **(AD-A—195352/0/XAB) Atmospheric-flow modeling in complex terrain. JANNAF Safety & Environmental Protection Subcommittee Workshop held in Vandenberg AFB, California on 26-27 September 1986. Workshop report, 1 September 1985-30 September 1986.** Paul, M.J. (Johns Hopkins Univ., Laurel, MD (USA). Chemical Propulsion Information Agency). Sep 1986. 216p. (CPIA-PUB—479). NTIS PC$42.00/MF$42.00.

Availability: National Technical Information Service, Springfield, VA 22161 PC$42.00 (No copies furnished by DTIC).

The subject of this workshop was to assess the current capabilities to model atmospheric flow in complex terrain. Emphasis was placed on Vandenberg Air Force Base, California, since it is one of the most complex areas being modeled and because of its operational importance. Also, Vandenberg is a good measure of current capabilities, since success in modeling this area would mean almost certain success with any area. Topics included: DoD flow modeling--A historical perspective; Incorporation of the critical streamline and mass-conservation principles in an efficient 3-D wind interpolation model; Physical assumptions in flow modelling and their effect on model performance; Description of the Meteorological and Range Safety Support (MARSS) system; Technology development for a computerized propellant hazard response protocol system; Modeling airflow over variable terrain; The REEDM wind flow model; Mean flow in Vandenberg terrain--Experimental results; Evaluation of a surface-layer windflow model for complex terrain using meteorological tower data from Vandenberg; Atmospheric models applied to Vandenberg terrain; Principal component analysis of the vector mesoscale wind field at Vandenberg AFB.

57452 **(CONF-8809129—1) Formation and general characteristics of environmental tobacco smoke.** Guerin, M.R. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 12p. NTIS, PC A03/MF A01. Order Number DE88016782/JAW.

From APCA specialty conference on combustion processes and the quality of the indoor environment; Niagara Falls, NY, USA (27 Sep 1988).

The primary source of environmental tobacco smoke is the the smoke released directly from the tips of cigarettes between puffs; the sidestream smoke. Sidestream smoke is formed under different conditions than is mainstream smoke. It is enriched in alkaline constituents, contains greater quantities of vapor phase water, exhibits a smaller particle size, and is less affected by smoking conditions and cigarette design. Upon dilution in ambient air, particle size decreases due to evaporation thus redistributing many constituents from the particle phase to the vapor phase. Commonly found concentrations of ETS particulates matter, nicotine, and carbon monoxide in indoor environments are 50-200 $\mu g/m^3$, 2-20 $\mu g/m^3$, and 2-6 ppM, respectively. Physical composition and chemical concentration vary both spatially and temporally as determined in large part by smoking severity and degree of ventilation. 22 refs., 4 tabs.

57453 **(CU/KC—8702) Environmental sulphur isotope studies in Alberta: a review.** Krouse, H.R. (Calgary Univ., Alberta (Canada). Kananaskis Centre for Environmental Research). Feb 1987. 111p. (MICROLOG—88-00573). Acid Deposition Research Program, 150 Sixth Ave. SW, Suite 3800, Calgary, Alta., Canada T2P 3Y7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Environmental sulfur isotope studies have been conducted in Alberta since the late sixties, and have been on the leading ege of the global investigations of anthropogenic S in the environment. Alberta is among the few places in the world where industrial emissions, e.g. from gas processing plants, differ greatly in isotopic composition from those of the preindustrial environments. Consequently, the investigations reviewed in this paper have not only served to identify and trace industrial S at locations in Alberta, but have contributed immensely to the understanding of fundamental concepts concerning uptake and utilization of S by environmental acceptors. This review covers principles of stable isotope research, including isotope fractionation and use of isotopes as tracers; sulfur isotope abundance variations in nature; oxygen isotope abundances in sulfates in relation to the sulfur cycle; sulfur isotope composition of environmental receptors, including atmosphere and atmospheric chemistry, surface and ground water, soils, and vegetation; conceptual modelling of sulfur isotope abundances in the environment surrounding sour gas plant operations; and recommendations for future research. 174 refs., 31 figs., 2 tabs.

57454 **(DP-MS—88-75) Dry deposition of sulfur and nitrogen oxide gases to forest vegetation.** Murphy, C.E. Jr.; Sigmon, J.T. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1987. Contract AC09-76SR00001. 24p. NTIS, PC A03/MF A01. Order Number DE89001394/JAW.

In this chapter we will discuss the transport mechanisms which move the sulfur and nitrogen oxide gases from the atmosphere to the vegetation and the soil surface. It is at these sites that the oxidizing gases chemically act to produce damage and/or become part of the nitrogen or sulfur cycles leading to acidification of forest soils. It is useful to discuss the transport of the acidic gases in terms of a model of the flow from the atmosphere to the vegetation and the soil. Others have described a number of models which use the analogy between electrical current and resistance to divide the flow of gases into compartments where the flow processes can be identified and individually modeled. The organization of this chapter is based on the flows and resistances. A more complex network takes into account the vertical distribution of canopy and air transport structure. This is certainly closer to the actual transport processes in a real canopy and has been used to predict pollutant uptake in models. The simpler network is based on the "big leaf" concept. It idealizes the canopy as an average leaf with average transport resistances from the atmosphere to the leaf surface. Use of this model, and also most of the multilevel models, assumes that near the surface of the earth vertical transport from the atmosphere to the surface dominates deposition. 74 refs., 3 figs., 1 tab.

57455 **(MST-LUFT-A—123) National air quality measuring program. Air quality measuring, annual report 1986.** Palmgren Jensen, F.; Kemp, K. (Miljoestyrelsen, Roskilde (Denmark). Luftforureningslab.). Apr 1988. 173p. (In Danish). NTIS (US Sales Only), PC A08. Order Number DE88754862/JAW.

At 30 monitoring stations the concentrations of sulphur dioxide and suspended particulate matter (SPM) were determined as 24 hr. mean values. In addition, the elemental compostion of SPM was established with respect to heavy metal. Nitrogen monoxide, nitrogen dioxide and sulphur dioxide were monitored as half hour mean values at one station in the towns and at two stations in the Greater Copenhagen Area. On the basis of the data collected in 1986 data evaluation was carried out in accordance with the following guidelines. 1. Assessment of the air pollution level in the seven Danish cities in relation to Danish or international limit values or guide lines. 2. Qualitative estimate of the origin of the air pollution. 3. Survey of the data with respect to the subsequent data analysis and discovery of air pollution problems. 4. Estimate of the trend of the

air quality. An evaluation of the air quality data from 1986 showed as earlier no violation of existing or proposed limit values in Denmark or in the EEC-countries for sulphur dioxide, SPM, lead or nitrogen oxides. The EEC-guide line of nitrogendioxide on 50 ug/m3 as annual mean and 135 ug/m3 as 98-percentiles was violated in Copenhagen at H.C. Andersens Boulevard. The measured annual mean concentrations of SPM were generally half the EEC-limit value of annual mean. Finally, the measured mean concentrations of lead at the most busy streets were approximately 1/4 of the EEC-limit value of annual mean on 2 ug/m3. The annual averages of lead have since 1982 been decreasing with more than a factor of two. Based on data from the period 1982-1986 the trends have been evaluated. The lead concentration decreased more than a factor of two in the period. The nitrogen dioxide concentration increased in most urban areas at locations with high traffic density. Other components did not show any general trend i.e. less than 5% per year. (EG).

57456 **(ORNL/TM—10908) Tropospheric ozone and vehicular emissions.** Russell, M. (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 46p. NTIS, PC A03/MF A01. Order Number DE89001328/JAW.

The paper examines changes in the transportation system as a means of reducing tropospheric ozone in the South Coast Air Basin of California. It takes this issue as a paradigm for the broader national situation where there are environmental risks for which no plausible or acceptable remedies exist. Its underlying thesis is that the cruel choices this prospect offers should be faced openly and public debate fostered. It summarizes the origins and the health risks of ozone, the current and prospective levels of control required to avoid them, the prospective contribution of transportation controls, and the information required to put the issue in a social benefits and social costs framework for decision. It contrasts this approach with that found in the Clean Air Act and in the amendments to it now before Congress.

57457 **(ORNL/TM—10909) Ozone pollution: The hard choices.** Russell, M. (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 52p. NTIS, PC A04/MF A01. Order Number DE89001329/JAW.

This paper examines tropospheric ozone pollution and alternative approaches for dealing with it. Its underlying message is that Congress should not act on any of the measures now before it to amend the Clean Air Act with regard to ozone. The paper examines the origins and health and environmental effects of ozone pollution and describes the magnitude of the present problem. It summarizes what would be required to attain the current Clean Air Act goals and finds that they may be unattainable in practice in some locations. It concludes that the Clean Air Act is flawed, and that a public debate should be encouraged on fundamental changes in its goals and framework. 2 tabs.

57458 **(PB—88-230909/XAB) Assessing asbestos exposure in public buildings.** Hatfield, J.; Stockrahm, J.; Todt, F.; Ogden, J.; Leczynski, B. (Battelle Columbus Div., OH (USA)). May 1988. 184p. NTIS, PC A09/MF A01.

Airborne asbestos levels were measured by direct transmission electron microscopy in 49 public buildings from three categories: (1) buildings without asbestos-containing material (ACM); (2) buildings with all or most of the ACM in good condition allowing for a limited number of areas of moderate damage; and (3) buildings with at least one area of significantly damaged ACM or numerous areas of moderate damage. Although the absolute airborne asbestos levels were very low, Category (3) had the highest median levels followed by Category (2), Category (1), and outdoors. Category (3) levels were significantly higher than Category (1). Another objective was to field test an assessment method for ACM developed facilitate abatement decision making in the context of an asbestos-management program. Using rate consistency as an evaluation criterion, the three factors showed promise as assessment tools for use in the field. Each factor showed statistically significant consistency among raters.

57459 **(PB—88-231055/XAB) Assessing the risks of trace gases that can modify the stratosphere: Volume 1. Executive summary.** Hoffman, J.S. (Environmental Protection Agency, Washington, DC (USA). Office of Air and Radiation). Dec 1987. 101p. (EPA—400/1-87/001A). NTIS, PC A06/MF A01.

See also Volume 2, PB—88-191853; Also available in set of 8 reports PC E99, PB—88-231048.

This document is one of a series that examines the human health, environmental, and atmospheric risks associated with a decrease in stratospheric ozone. It provides a synopsis of current understanding of how atmospheric composition may change and the effects the change is likely to have on ozone abundance and its vertical distribution. It includes the impacts of the changes in ozone on human health, polymers, plants, and aquatic systems. It also examines related changes in climate and the potential impacts of climate change on sea level rise, agriculture, human health, water resources and forests.

57460 **(PB—88-231063/XAB) Ultraviolet radiation and melanoma: with a special focus on assessing the risks of stratospheric ozone depletion.** Hoffman, J.S.; Longstreth, J.D. (Environmental Protection Agency, Washington, DC (USA). Office of Air and Radiation). Dec 1987. 560p. (EPA—400/1-87/001D). NTIS, PC A24/MF A01.

See also Volume 3, PB—88-191861 and Volume 5, PB—88-191879; Also available in set of 8 reports PC E99, PB—88-231048.

This document is part of a series of documents that examines the human health, environmental, and atmospheric effects associated with a decrease in stratospheric ozone. This volume, in particular, addresses the effects to human health and the relationship between ultraviolet radiation and melanoma.

57461 **(PB—88-231071/XAB) Assessing the risks of trace gases that can modify the stratosphere. Volume 6. Technical support documentation production projections.** Hoffman, J.S. (Environmental Protection Agency, Washington, DC (USA). Office of Air and Radiation). Dec 1987. 349p. (EPA—400/1-87/001F). NTIS, PC A15/MF A01.

See also Volume 5, PB—88-191879, and Volume 7, PB—88-231089; Also available in set of 8 reports PC E99, PB—88-231048.

This document is one of a series that examines the human health, environmental, and atmospheric risks associated with a decrease in stratospheric ozone. This volume includes reports on: Probabilistic projections of chlorofluorocarbon consumption; Scenarios of chlorofluorocarbon use: 1985-2075; Product uses and market trends for potential ozone depleting substance 1985-2000; and An analytic method for constructing scenarios from a subjective joint possibility distribution.

57462 **(PB—88-231089/XAB) Assessing the risks of trace gases that can modify the stratosphere. Volume 7. Technical support documentation atmospheric science papers.** Hoffman, J.S. (Environmental Protection Agency, Washington, DC (USA). Office of Air and Radiation). Dec 1987. 214p. (EPA—400/1-87/001G). NTIS, PC A10/MF A01.

See also Volume 6, PB—88-231071, and Volume 8, PB—88-231097; Also available in set of 8 reports PC E99, PB—88-231048.

This document is one of a series that examines the human health, environmental, and atmospheric risks associated with a decrease in stratospheric ozone. It includes 5 atmospheric science papers on atmospheric modeling. Photochemistry-model sensitivity to chlorine perturbations, ozone perturbations in the LLNL one-dimensional model, Monte Carlo uncertainty analysis of stratospheric ozone, ozone changes of the troposphere and stratosphere, and ultraviolet solar flux incident on the biosphere are discussed.

57463 **(PB—88-231097/XAB) Assessing the risks of trace gases that can modify the stratosphere. Volume 8. Technical support documentation ozone depletion and plants.** Teramura, A.H. (Environmental Protection Agency, Washington, DC (USA). Office of Air and Radiation). Dec 1987. 138p. (EPA—400/1-87/001H). NTIS, PC A07/MF A01.

See also Volume 7, PB—88-231089; Also available in set of 8 reports PC E99, PB—88-231048.

This document is one of a series that examines the human health, environmental, and atmospheric risks associated with a decrease in stratospheric ozone. It focuses on issues and uncertainties in assessing the effects of UV-B radiation on plants as well as risks to crop yield resulting from an increase in solar UV-B radiation. Recommendations are made for improving field experimental design and management.

57464 **(PB—88-233853/XAB) National Acid Precipitation Assessment Program annual report to the President and Congress (1984).** (Interagency Task Force on Acid Precipitation, Washington, DC (USA)). 1984. 97p. NTIS, PC A05/MF A01.

See also PB—85-116713.

The goal of the federally-sponsored National Acid Precipitation Assessment Program is to develop and progressively improve upon the analytical tools necessary to understand processes critical to the acid-precipitation issue. The program is developing these tools to provide an objective and comprehensive information base on acid precipitation for use by decision makers. The Annual Report to the President and Congress, required by law, outlines the specific accomplishments of the National Program during 1984, summarizes selected factors in the state of scientific knowledge, presents a list of publications produced under the National Program, and describes the outlook for continued research progress.

57465 **(PB—88-234067/XAB) Development and evaluation of composite-receptor methods.** Dzubay, T.G. (Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab.). Jul 1988. 63p. (EPA—600/3-88/026). NTIS, PC A04/MF A01.

A composite-receptor method for PM-10 apportionment was evaluated to determine the stability of its solutions and to devise cost-effective measurement strategies. Aerosol samples used in the evaluation were collected during summer, 1982, by dichotomous samplers at three sites in the vicinity of Philadelphia, PA. The composite receptor method consisted of a wind-trajectory method, chemical mass balance (CMB), and multiple linear regression (MLR). Measured lead minus a CMB-derived correction for other sources was used as an independent variable in MLR, and MLR results for the Pb abundance in vehicle exhaust agreed with predictions of a model for vehicle emission factors. In resolving PM-10 into 11 components, scanning electron microscopy was essential for coal-fly ash and botanical matter, x-ray fluorescence (XRF) was needed for the sulfur-component and vehicle exhaust, and instrumental neutron-activation analysis (INAA) was essential for fluidized catalytic crackers at refineries.

57466 **(PB—88-234166/XAB) Volatile Organic Compound Model: quality assurance and sensitivity testing (Version 1.8), Final report, February 1986-September 1987.** Jennings, M.S.; Emmel, T.E. (Radian Corp., Research Triangle Park, NC (USA)). Jul 1988. 225p. NTIS, PC A10/MF A01.

For system on diskette, see PB—88-157888.

This report describes test runs of the Volatile Organic Compound Model (VOCM), Version 1.8. VOCM predicts future emission levels of volatile organic compounds (VOCs) by projecting uncontrolled base-year emissions into the future. These projected emissions are then reduced by constraints to predict future controlled emissions of VOCs. VOCM is a program that runs on the IBM-PC series of computers. The VOCM test runs in the report were performed: (1) to verify that the calculations and operation of VOCM are in accordance with the specifications and design of the model, and (2) to exercise the model with actual data developed under the National Acid Precipitation Assessment Program. Test run results show that the model operates as designed. Test runs with NAPAP data predict an overall annual growth rate of VOC emissions for the U.S. of about 1.6% per year for the projection horizon of 1980 to 2010. An overall growth in VOC emission control costs of about 4.1% is also predicted.

57467 **(PB—88-234174/XAB) Effect of relative humidity and additives on the reaction of sulfur dioxide with calcium hydroxide. Final report, January 1984-June 1986.** Ruiz-Alsop, R.; Rochelle, G.T. (Texas Univ., Austin (USA). Dept. of Chemical Engineering). Jul 1988. 219p. NTIS, PC A10/MF A01.

This paper gives results of a study of the reaction of SO_2 with $Ca(OH)_2$ at conditions similar to those of commercial-scale bag filters: 19-74% relative humidity (RH), 30.4-95 C, and 300-4000 ppm SO_2. The study was carried out in a bench-scale reactor with powder reagent $Ca(OH)_2$ dispersed in silica sand. The gas phase was a mixture of N_2, SO_2, and water vapor. The effects of $Ca(OH)_2$ leading, temperature, RH, inlet SO_2 concentration, and additives were investigated. Of the additives tried (buffer acids, and organic and inorganic deliquescents), only the deliquescent salts improved $Ca(OH)_2$ reactivity toward SO_2. The improvement depends on the type and amount of salt and on the RH. The experimental data were modeled by a shrinking core model with zero-order kinetics in SO_2, using an empirical correlation to account for shape and surface roughness of the $Ca(OH)_2$ particles. The diffusion coefficient of the SO_2 through the product layer (De) increases linearly with RH and the amount of additive, and the kinetic rate constant (ks) increases exponentially with RH and the amount of additive.

57468 **(SAND—88-0121) The Albuquerque carbon monoxide source apportionment study.** Einfeld, W. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1988. Contract AC04-76DP00789. 174p. (TTC—0792). NTIS, PC A08. Order Number DE89001056/JAW.

At the request of the New Mexico Environmental Improvement Division, a study was carried out to examine, in detail, the relative contribution of various combustion sources to ambient carbon monoxide in Albuquerque during the winter season evening hours. The two-month field study (January--February 1985) included aerosol and gas monitoring at two sites in the Albuquerque area. Source contributions to ambient carbon monoxide were determined by regression techniques using tracer elements and by carbon isotope measurements on collected carbon monoxide. Results from isotopic carbon analysis of carbon monoxide show that, on average, mobile sources contributed 68 percent and wood burning sources 32 percent to ambient carbon monoxide levels during winter season evening hours. Good agreement was found between results from carbon isotope and linear regression techniques used to estimate average source strengths. The study results point to the significance of both mobile and residential wood burning sources as contributors to ambient carbon monoxide levels. 1 ref., 10 figs., 19 tabs.

57469 **(SAND—88-1282) The Dallas winter visibility study.** Einfeld, W.; Dattner, S.; Zimmermann, K. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1988. Contract AC04-76DP00789. 85p. (TTC—0807). NTIS, PC A05/MF A01. Order Number DE89001060/JAW.

For some years, a highly visible cloud of polluted air could be seen over the city during winter season stagnation conditions. A historical study of visual range data collected from local airports conducted by the Texas Air Control Board showed a decreasing trend in the number of good visibility days per year over the past 35 years and, that the average visibility has decreased by 50 percent since 1940. Specific data describing the haze composition or source contributions to the winter pollution haze were limited. The purpose of this study, was to determine the composition of the visible haze, and from that information, determine the relative contribution of the various air pollution sources in the Dallas area to winter visibility impairment. Two existing air quality monitoring stations were augmented with additional instrumentation for this study. 18 figs., 18 tabs.

57470 **(UCRL—21111) Climate change and its interactions with air chemistry: Perspectives and research needs.** Penner, J.E.; Connell, P.S.; Wuebbles, D.J.; Covey, C.C. (Lawrence Livermore National Lab., CA (USA)). Aug 1988. Contract W-7405-ENG-48. 92p. NTIS, PC A05/MF A01. Order Number DE89001531/JAW.

This paper attempts to outline and estimate the interactions between climate change and atmospheric chemistry that need investigation on both local and/or regional and global scales. The problem is not simply one of estimating temperature change and running chemical models we already possess to get an answer. The ways that a changing climate influences atmospheric chemistry include not only temperature and precipitation changes, but changes to atmospheric transport processes, changes to the budgets of species

with biological sources (which respond to temperature and moisture changes), changes to vegetative cover which would alter deposition rates, changes in the rate of export of pollutants from the urban/regional environment to the global one, etc. Furthermore, changes in atmospheric chemical composition will lead to climate change. Figure 1.1 gives an overview of the climate/chemistry system and the interactions that it will be necessary to understand in order to predict the future state of our planet. The responses of these various subsystems may be highly coupled to both each other and the climate change itself. For example, climate change has the potential to alter water vapor concentrations. Changes in the concentration of water vapor would profoundly alter many species concentrations by impacting atmospheric OH concentrations, because OH acts as a scavenger for many pollutants. Changes to H_2O will also impact tropospheric O_3 concentrations. Because O_3 absorbs infrared radiation, these changes will feed back to alter the climate. As another example, climate change also has the potential to alter the biological sources and sinks of certain gases. Because biological processes supply many of the species of radiative importance in the troposphere, changes in these sources will feed back to alter the climate response. 148 refs.

57471 **(UCRL—21111-Exec.Summ.) Climate change and its interactions with air chemistry: Perspectives and research needs: Executive summary.** Penner, J.E.; Connell, P.S.; Wuebbles, D.J.; Covey, C.C. (Lawrence Livermore National Lab., CA (USA)). Jun 1988. Contract W-7405-ENG-48. 17p. NTIS, PC A03/MF A01. Order Number DE89001532/JAW.

This paper attempts to outline and estimate where possible the interactions between climate change and atmospheric chemistry that need investigation on both local and/or regional and global scales. The problem is enormously complex and is not simply one of estimating temperature change and running chemical models we already possess to get an answer. The ways that a changing climate influences atmospheric chemistry include not only temperature and precipitation changes, but changes to atmospheric transport processes, changes to the budgets of species with biological sources (which respond to temperature and moisture changes), changes to light levels due to stratospheric ozone depletion which would alter photolysis rates, changes to vegetative cover which would alter deposition rates, changes in the rate of export of pollutants from the urban/regional environment to the global one, etc. Furthermore, changes in atmospheric chemical composition will lead to climate change. 10 refs., 3 figs., 3 tabs.

57472 **(UCRL—98314) A study of the sensitivity of stratospheric ozone to hypersonic aircraft emissions.** Kinnison, D.E.; Wuebbles, D.J.; Johnston, H.S. (Lawrence Livermore National Lab., CA (USA)). Sep 1988. Contract W-7405-ENG-48;AC03-76SF00098. 6p. (CONF-8809167—1). NTIS, PC A02/MF A01. Order Number DE89001240/JAW.

From 1. international conference on hypersonics flight in the 21st century; Grand Forks, ND, USA (20 Sep 1988).

There recently has been new interest in the development of faster and more efficient aircraft for intercontinental passenger flights. Such aircraft would likely spend a high fraction of their flight time in the stratosphere. As a natural progression from studies that were done during the CIAP Program in the mid 1970s, this study investigates the sensitivity of stratospheric ozone to NO/sub x/ and HO/sub x/ emissions in conjunction with current understanding of atmospheric chemical and physical processes. The LLNL one-dimensional and two-dimensional chemical-radiative-transport models of the troposphere and stratosphere are used in this investigation. Because of the significant uncertainties in possible future emissions, it is necessary that we examine the models sensitivity to a wide range in magnitude, altitude, and latitude of assumed emissions. As well as examining different NO/sub x/ and HO/sub x/ emission levels, attempts are also made to examine the sensitivity of ozone to emissions under different background amounts of stratospheric chlorine (CIX). These studies lay the groundwork for future studies aimed at analyses of more realistic aircraft emission scenarios.

57473 **(UCRL—98443) Sensitivity of a two-dimensional chemistry-transport model to changes in parameterizations of radiative processes.** Grant, K.E.; Ellingson, R.G.; Wuebbles, D.J. (Lawrence Livermore National Lab., CA (USA)). Aug 1988. Contract W-7405-ENG-48. 9p. (CONF-8808125—1). NTIS, PC A02/MF A01. Order Number DE88016273/JAW.

From International radiation symposium; Lille, France (18 Aug 1988).

Radiative processes strongly effect equilibrium trace gas concentrations both directly, through photolysis reactions, and indirectly through temperature and transport processes. As part of our continuing radiative submodel development and validation, we have used the LLNL 2-D chemical-radiative-transport (CRT) model to investigate the net sensitivity of equilibrium ozone concentrations to several changes in radiative forcing. Doubling CO_2 from 300 ppmv to 600 ppmv resulted in a temperature decrease of 5 K to 8 K in the middle stratosphere along with an 8% to 16% increase in ozone in the same region. Replacing our usual shortwave scattering algorithms with a simplified Rayleigh algorithm led to a 1% to 2% increase in ozone in the lower stratosphere. Finally, modifying our normal CO_2 cooling rates by corrections derived from line-by-line calculations resulted in several regions of heating and cooling. We observed temperature changes on the order of 1 K to 1.5 K with corresponding changes of 0.5% to 1.5% in O_3. Our results for doubled CO_2 compare favorably with those by other authors. Results for our two perturbation scenarios stress the need for accurately modeling radiative processes while confirming the general validity of current 2-D CRT models. 15 refs., 5 figs.

57474 **Chromate removal from aqueous wastes by reduction with ferrous ion.** Eary, L.E.; Rai, D. (Battelle Pacific Northwest Laboratories, Richland, WA (USA)). *Environmental Science and Technology;* **22**: No. 8, 972-977(Aug 1988).

Experimental measurements of reaction stoichiometries indicate that optimum conditions for chromate removal from oxygenated, 25°C aqueous wastes by reduction with ferrous ion occur at pH less than 10.0 in solutions containing the following anions: ClO_4^-, Cl^-, F^-, NO_3^-, and PO_4^{3-}. At pH greater than 10.0 and at lower pH in solutions that contain greater than 10^{-4} M total phosphate, chromate is less efficiently reduced by ferrous ions as evidenced by nonstoichiometric reduction. Nonstoichiometric reduction of the chromate by the ferrous ion is caused by the competitive oxidation of the ferrous ions by dissolved oxygen. Depending on pH and solution composition, the reduction of chromate by ferrous ions causes rapid precipitation of (Cr/sub x/Fe/sub 1-x/)$(OH)_3$(s). The solubility of this solid limits Cr(III) concentrations, between pH 5.0 and pH 11.0, to less than the drinking water limit of 10^{-6} M.

57475 **Improved particle impactor assembly for size selective high volume air sampler.** Langer, G. US Patent Application 6-028,981. 23 Mar 1987. 34p. Contract AC04-76DP03533. NTIS, PC A03/MF A01.

Air containing entrained particulate matter is directed through a plurality of parallel, narrow, vertically oriented apertures of an inlet element toward an adjacently located, relatively large, dust impaction surface preferably covered with an adhesive material. The air flow turns over the impaction surface, leaving behind, the relatively larger particles and passes through two elongate apertures defining the outer bounds of the impaction collection surface to pass through divergent passages which slow down and distribute the air flow, with entrained smaller particles, over a fine filter element that separates the fine particles from the air. By appropriate selection of dimensions and the number of inlet apertures air flow through the inlet element is provided a nonuniform velocity distribution with the lower velocities being obtained near the center of the inlet apertures, to separate out particles larger than a certain predetermined size on the impaction collection surface. The impaction collection surface, even in a moderately sized apparatus, is thus relatively large and permits the prolonged sampling of air for periods extending to four weeks. 6 figs.

57476 **Room air monitor for radioactive aerosols.** Balmer, D.K.; Tyree, W.H. US Patent Application 6-028,982. 23 Mar 1987. 15p. Contract AC04-76DP03533. NTIS, PC A03/MF A01.

A housing assembly for use with a room air monitor for simultaneous collection and counting of suspended particles includes a casing containing a combination detector-preamplifier system at one end, a filter system at the other end, and an air flow system consisting of an air inlet formed in the casing between the detector-preamplifier system and the filter system and an air passageway extending from the air inlet through the casing and out the end opposite the detector-preamplifier combination. The filter system collects suspended particles transported directly through the housing by means of the air flow system, and these particles are detected and examined for radioactivity by the detector-preamplifier combination. 2 figs.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 56607, 56609, 56610, 57444, 57473, 57483, 58273

57477 **(DPST—86-624) Summary of Chernobyl fallout monitoring by the Environmental Radiometrics Group.** Kantelo, M.V.; Winn, W.G. (Savannah River Lab., Aiken, SC (USA)). 14 Aug 1986. Contract AC09-76SR00001. 21p. NTIS, PC A03/MF A01. Order Number DE89000486/JAW.

Fallout from the Chernobyl nuclear reactor accident has been continuously monitored since early May. The fallout radioactivity peaked during May 10-11, but it has now essentially dissipates, as it has decreased by a factor of several thousand. 2 refs., 7 figs., 4 tabs.

57478 (INIS-mf—11311, pp 8) **Aerosol particle size distribution in dependence on the type of radionuclide after the Chernobyl accident and in the NPP effluents (poster).** Rulik, P.; Bucina, I.; Malatova, I. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57479 (INIS-mf—11311, pp 16) **Measurements of the indoor radon concentration.** Nikezic, D.; Markovic, P. (Faculty of Natural Sciences, Kragujevac (Yugoslavia)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57480 **(OEFZS—4452) Dose contribution of /sup 90/Sr to the ingestion dose after the Chernobyl accident.** Mueck, K.; Streit, S.; Steger, F.; Mayr, K. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Strahlenschutz). (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Jun 1988. 80p. (In German). (ST—157/88). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704061/JAW.

The exposure of the Austrian population due to /sup 90/Sr after the reactor accident at Chernobyl was estimated by measurement of the /sup 90/Sr-content in 131 food samples, 9 drinking water samples and 7 other samples. The samples were taken at different times after the accident to take into account changes in the activity content with time. In order to estimate the contri-bution of the reactor accident compared to /sup 90/Sr from the atomic bomb testing, also samples of the time before the incident were evaluated. Considering the average food consumption one obtains an weighted effective dose equivalent of 0,006mSv for the adult and 0,01mSv for the one year old child. For the infant the dose in first half year of his life amounts to 0,00006mSv if fed with woman milk, respectively 0,0009mSv if fed with infant food. Approximately half of the dose of /sup 90/Sr may be attributed to the reactor accident, the other half is attributable to /sup 90/Sr of the weapon testing. The dose in the second year after the accident amounts to approximately 70% of the dose in the first year of which 70% are caused by / sup 90/Sr from the weapons testing. 20 refs., 30 tabs., 10 figs.

57481 **(OEFZS-A—1000) TSCHER: a data bank for samples which were measured in Austria following the Chernobyl accident (preliminary version).** Kunsch, B.; Humer, H. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Physik). (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). May 1987. 7p. (PH—444/87). Austrian Research Centre Seibersdorf, A-2444 Seibersdorf, Austria.

Limited distribution.

TSCHER contains samples measured by the Austrian Research Centre Seibersdorf (ARCS). The samples were provided either by authorities or by private persons and companies. Informations describing the samples are given as obtained. Most of the samples came from Styria, Carinthia and Salzburg county.

57482 **(ORNL/TM—10782) TRANFOOD: Radionuclide transport via terrestrial food chain.** Uslu, I.; Fields, D.E.; Yalcintas, M.G. (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 29p. NTIS, PC A03/MF A01. Order Number DE89001836/JAW.

A dynamic, time-dependent model has been developed for simulation of an acute environmental transfer of radionuclides through agricultural systems. TRANFOOD is a computer code which calculates concentration of radionuclides in surface and root-zone soil, deep soil, produce and feed, and beef and milk from a given initial surface concentration of radioactivity from fallout. The preliminary validation of the model was carried out by comparing the results with Chernobyl Nuclear Accident data of the Federal Republic of Germany. The measured and calculated results are in agreement, inasmuch as nearly the same amount of peak specific activities were seen, but there is a sharp reduction of measured specific activity values for both ^{137}Cs and ^{131}I after May 5, 1986. The differences in observed and simulated values for this period is likely due to some protective actions which had been taken in the Federal Republic of Germany. Cattle and other livestock had been sequestered and given stored feed to minimize uptake from contaminated forage. 24 refs., 2 figs., 9 tabs.

5006 Regulations

REFER ALSO TO CITATION(S) 56721

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

57483 **(OEFZS—4447) Basis data for the regional prognosis of the human radiation burden by the model ECOSYS. 1st preliminary report: Estimation of the soil deposition of / sup 137/Cs by the Tschernobyl accident/Literature review about transfer factors.** Horak, O.; Gerzabek, M. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Landwirtschaft). (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Apr 1988. 21p. (In German). (LA—198/88). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704058/JAW.

From the results of gammaspectrometric measurements on soil profiles of different sites in Austria, the surface deposition of / sup 137/Cs as a consequence of the Chernobyl reactor accident was calculated. The activity deposit per square meter was found in a range between 20 nCi (740 Bq) in the northeastern part of Lower Austria and 2453 nCi (90761 Bq) in Upper Austria. The intercomparison of soil-plant and plant-animal transfer factors used in the terrestrial food chain model ECOSYS with recent literature data shows a good agreement. Only the Cs-transfer factor for milk seems to overestimate the real Cs-retention. 18 refs., 10 tabs.

5101 Basic Studies

REFER ALSO TO CITATION(S) 56722, 57084, 57430, 57571

57484 (CONF-8608141—2) A dendroecological approach for studying inter-tree competition. Doyle, T.W. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01. Order Number DE89000426/JAW.

From Industrial symposium on ecological aspects of tree ring analysis; Tarrytown, NY, USA (17 Aug 1986).

The purpose of this research was to implement dendroecological techniques to investigate the nature and extent of inter-tree competition in a natural, mixed-aged, mixed-species forest. Sampling involved coring and mapping study trees and neighbors in a forest stand. Measurements of diameter, crown class and core orientation were taken along with tree azimuth and distance from plot center. Cores were crossdated and measured to determine age, sapwood basal area, ring width and basal area increment. A computer model recreated plot and tree configurations in order to calculate and test newly proposed competition measures as well as published indices. These indices were evaluated on their performance under different competitor selection criteria and assumptions. Analysis focused on competition and growth relationships as influenced by community structure and development, climatic conditions and species interaction. The study design, results and applications are discussed to emphasize the unique qualities of a combined dendroecological and model approach for studying competition. 19 refs.

57485 (CONF-8810133—1) A positioning and data logging system for surface geophysical surveys. Nyquist, J.E.; Blair, M.S. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01. Order Number DE88015293/JAW.

From Field screening methods for hazardous waste site investigations; Las Vegas, NV, USA (11 Oct 1988).

The Ultrasonic Ranging and Data System (USRADS) developed at ORNL is being adapted to work with two commercially available geophysical instruments: a magnetometer and an EM31 terrain conductivity meter. Geophysical surveys have proven an important preliminary step in investigating hazardous waste sites. Magnetometers and terrain conductivity meters are used to locate buried drums, trenches, conductive contaminant plumes and map regional changes in geology. About half the field time of a typical geophysical investigation is spent surveying the position of the grid points at which the measurements will be made. Additional time is lost and errors may be made recording instrument values in field notebooks and transcribing the data to a computer. Developed for gamma radiation surveys, the USRAD system keeps track of the surveyor's position automatically by triangulating on an ultrasonic transmitter carried in a backpack. The backpack also contains a radio transmitter that sends the instrument's reading coincident with the ultrasonic pulse. The surveyor's position and the instrument's reading are recorded by a portable computer which can plot the data to check the survey's progress. Electronic files are stored in a form compatible with AutoCAD to speed report writing. 7 refs., 3 figs.

57486 (CU/KC—8702) Major biophysical components of Alberta. Jaques, D.R. (Calgary Univ., Alberta (Canada). Kananaskis Centre for Environmental Research). Feb 1987. 106p. (MICROLOG—88-00576). Acid Deposition Research Program, 150 Sixth Ave. SW, Suite 3800, Calgary, Alta., Canada T2P 3Y7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This study has provided inventory data for macroclimatic regions, physiographic subdivisions, bedrock geology, and vegetation cover of the entire province of Alberta except for national parks. Compilation of data on each of these major biophysical components of Alberta ecosystems is important for evaluation of potential impacts of acid depositions on terrestrial and aquatic ecosystems. Each bedrock formation in Alberta has been rated as to its potential buffering capacity for acid deposition. Twelve major macroclimatic regions have been recognized, along with 11 physiographic regions. 134 vegetation community types have been identified and described throughout the province. Many of these types are restricted to, and are useful in characterizing, each of the macroclimatic regions. 67 dominant plant species have been identified in all of the known community types. The community type analysis of Alberta vegetation has shown that the major climatically controlled subdivisions exist in the subalpine, montane, parkland, and boreal uplands regions. The inventory data and conclusions generated by this survey have led to recommendations aimed at producing a framework and mechanism for mapping and evaluating potential impacts of acid deposition on forest, non-forest and agricultural systems of Alberta. 409 refs., 20 tabs.

57487 (IAEA-TECDOC—464, pp 23-29) Downhole assaying in Canadian mineral deposits with the spectral gamma-gamma method. Killeen, P.G.; Mwenifumbo, C.J. (Geological Survey of Canada, Ottawa, Ontario). Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704190/JAW. (CONF-8711234—).

From Consultants' meeting on current trends in nuclear borehole logging techniques for elemental analysis; Ottawa, Canada (2 Nov 1987).

The Borehole Geophysics Section at the Geological Survey of Canada is conducting research into the Spectral Gamma Gamma (SGG) logging method with the objective of developing a borehole assay technique suitable for use in Canadian mineral exploration and mine development. The SGG method is based on the different interactions of gamma rays with matter. After gamma rays from a radioactive source have interacted with rock the gamma ray energy spectrum contains information about the atomic number (Z) of the elements in the rock. A special radioactive source holder has been designed to attach to the nose of a spectral gamma ray logging probe in order to make SGG measurements. A series of different collimators designed to focus the gamma rays radially out into the rock at angles of 90 deg., 60 deg., 45 deg. and 30 deg. to the probe, and a series of different spacers to permit variations in source-detector spacing have been fabricated from tungsten. In addition, sources with different gamma ray energies (Cobalt 60, Cesium 137, Iridium 192) have been tested. A number of experiments have been conducted, varying all of the above parameters and the energy windows. The SGG probe has been field tested using some of the experimental configurations in boreholes intersecting different types of mineralization. The high Z values of lead in lead deposits is easily detectable and semi quantitative assay logs have been produced. Barite and pyrite associated with gold mineralization has also been detected and sphalerite-rich zones have been delineated in a zinc mining area. (author). 3 refs, 6 figs.

57488 (IAEA-TECDOC—464, pp 31-53) Quantitative nuclear borehole logging based on neutron excited gamma reactions. Borsaru, M.; Eisler, P.L.; Charbucinski, J. (Commonwealth Scientific and Industrial Research Organization, Port Melbourne (Australia). Div. of Mineral Engineering). Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704190/JAW. (CONF-8711234—).

From Consultants' meeting on current trends in nuclear borehole logging techniques for elemental analysis; Ottawa, Canada (2 Nov 1987).

The application of the spectrometric neutron-gamma method for coal ash and soil salinity quantitative determinations has been described. The results of field tests for ash-in-coal determinations carried out in dry and water-filled boreholes of eight Australian black coal deposits are discussed. The borehole logging system-SIROLOG, now commercially available is described. The latest version of SIROLOG neutron-gamma probe achieved values of rms deviation better than 2% ash in most tests, both in water-filled and dry boreholes and for coals of ash content in the range 3 to 50%. The laboratory measurements and the preliminary field tests for quantitative logging of salinity in soils are described. A spectrometric neutron-gamma method using a 252-Cf source and a BGO detector was applied. Major constraints of affecting salinity logging were identified. The most important of these were simulated in laboratory tests and evaluated. (author). 20 refs, 17 figs, 3 tabs.

57489 (IAEA-TECDOC—464, pp 55-66) **Elemental concentrations from gamma ray spectroscopy logs.** Schweitzer, J.S.; Ellis, D.V.; Grau, J.A.; Hertzog, R.C. (Schlumberger-Doll Research Center, Ridgefield, CT (USA); Schlumberger Well Services, Houston, TX (USA)). Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704190/JAW. (CONF-8711234—).

From Consultants' meeting on current trends in nuclear borehole logging techniques for elemental analysis; Ottawa, Canada (2 Nov 1987).

A set of gamma-ray spectrometers have been combined in a single tool string to routinely obtain elemental concentrations for ten formation elements in a single logging run. The key to obtaining the elemental concentrations for the set of significant elements is a new technique for combining logging measurements using different types of nuclear reactions through a model based on both nuclear physics and geochemistry. The model has been validated by comparisons between logging and core analysis results for numerous wells. (author). 13 refs, 5 figs, 3 tabs.

57490 (IAEA-TECDOC—464, pp 67-92) **Borehole capture gamma ray spectrometry in very dry rock.** Senftle, F.E.; Mikesell, J.L. (Geological Survey, Reston, VA (USA)). Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704190/JAW. (CONF-8711234—).

From Consultants' meeting on current trends in nuclear borehole logging techniques for elemental analysis; Ottawa, Canada (2 Nov 1987).

Using a simulated borehole geometry, prompt gamma-ray spectra have been recorded in four large salt samples, each having a small but different water concentration. Spectra were taken in both dry and water-filled boreholes using a /sup 252/Cf neutron source. Analysis of the data shows a very high ratio of fast neutron fluence rate to thermal neutron fluence rate which decreases sharply with increasing concentrations of water. The high ratio is primarily the result of strong thermal neutron absorption by chlorine. The high neutron fluence rate ratios found in dry salt suggest the possibility of significant contributions to the spectra by non-thermal neutron capture gamma-rays. Examination of the counts in the chlorine capture gamma-ray peaks showed no evidence of significant effects on the capture intensities by non-thermal neutron absorption even in dry boreholes and in the driest salt samples measured. This conclusion is supported by the lack of line broadening in the capture gamma-ray spectra. Rock with a macroscopic cross section as high as that of salt is rare; thus the depression of the thermal neutron fluence rate found in dry salt is an extreme case. There need be little concern that capture gamma-ray spectra taken in a borehole in common rocks will be altered by resonance or fast neutron absorption. The thermal neutron fluence rate in relatively dry salt at a source-to-detector distance of 39 cm increases with small increments of formation water. Published data for common rocks indicate the opposite is true for higher concentrations of water. The apparent discrepancy is due to the movement of the cross-over point toward greater distances from the source as the water concentration becomes very low. (author). 26 refs, 6 figs, 4 tabs.

57491 (IAEA-TECDOC—464, pp 93-104) **Nuclear quantitative analysis of P, Si, Ca, Mg, Fe, Al in boreholes on a phosphate mine.** Pinault, J.L. (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)). Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704190/JAW. (CONF-8711234—).

From Consultants' meeting on current trends in nuclear borehole logging techniques for elemental analysis; Ottawa, Canada (2 Nov 1987).

Neutron-gamma logging has been applied to determine the grade of ore in preproduction holes drilled into a layered phosphate deposit. The probe was systematically passed down each borehole with each of the two sources: Am/Be or Cf successively. The first source emits fast neutrons favouring measurement of phosphorus and magnesium (inelastic scattering) whereas the second is preferable for measurement of silicium, calcium, iron and aluminium. However the ore has a high water content which strongly modifies the energy (capture) distribution of the Am/Be source and allows simultaneous detection of all the elements by using only the Am/Be source. The probe was raised at a speed of 6 m/h. The sampling interval was about 50 cm. The calibration operation was made from analysis from homogeneous ore. The peak area due to capture of neutrons by hydrogen was only introduced into the model so as to take into account disturbances introduced by water. The relative errors are less than 10% for the major components: P, Si, Ca. In some instances, large differences were revealed between the "in situ" analysis and ore grade determination from cores because of ore heterogeneity. The analysis on cores are very erratic from one borehole to another while analysis by activation reveals regionalization phenomena due to its great representativity. (author). 3 refs, 9 figs.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 56038, 56120, 56447, 57453, 57506, 57512, 57513, 57514, 57522, 57531, 57602, 57607, 57611, 57617

57492 (AD-A—195334/8/XAB) **Drum-centrifuge study of the transport of leachates from landfill sites. Final report, April 1986-April 1988.** Gronow, J.R.; Edwards, R.I.; Schofield, N.A. (Cambridge Univ. (UK). Dept. of Engineering). 5 May 1988. 117p. (CUED/D-SOILS/TR—214). NTIS, PC A06/MF A01.

This report gives the results of a feasibility study of drum centrifuge modelling of transport phenomena. A discussion of the modeling of transport processes in general is included, together with a description of the scaling of accelerated physical models and the verification of scaling assumptions. This is followed by a description of the laboratory and lg experiments to determine the physical properties of the model medium and pollutant used and to estimate the sorption, diffusion, and dispersion coefficients required in the modeling of transport processes. Details are given of the construction of the two-drum centrifuge models used, together with the results of the second centrifuge test. These results were obtained both in flight and from analysis of cores and from ultraviolet photography after the test. These are discussed in the context of the role of geotechnical centrifuge modeling in the verification of numerical models of porous media transport.

57493 (CONF-880521—6) **Bioremediation of polychlorinated biphenyls: Degradation capabilities in field lysimeters.** Hill, D.L.; Phelps, T.J.; Palumbo, A.V.; White, D.C.; Strandberg, G.W.; Donaldson, T.L. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 19p. NTIS, PC A03/MF A01. Order Number DE89000451/JAW.

From 10. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (16 May 1988).

The degradation of 4-chlorobiphenyl (4CB) was compared in field lysimeters containing 60 Kg of soil contaminated with 5-10 mg/Kg of polychlorinated biphenyls. Alcaligenes A5, a bacterium carrying a plasmid for 4CB degradation, was inoculated into three lysimeters. When compared to an untreated control, soil samples from water, mineral and yeast extract treated lysimeters with and without a bacterial inoculum exhibited greater than TO fold increases in the rate of [1-^{14}]C-acetate incorporation into lipids and $^{14}CO_2$ production from [U-^{14}C-]4-chlorobiphenyl. Gene probe analyses for the 4CB plasmid and most-probable number enumerations demonstrated the presence of biodegradative populations in lysimeters and the probable survival of the added Alcaligenes A5. 17 refs., 2 figs., 2 tabs.

57494 (CU/KC—8702) **Effects of acid deposition on soils in Alberta.** Turchenek, L.W.; Abboud, S.A.; Tomas, C.J.; Fessenden, R.J.; Holowaychuck, N. (Calgary Univ., Alberta (Canada). Kananaskis Centre for Environmental Research). Feb 1987. 214p. (MICROLOG—88-00575). Acid Deposition Research Program, 150 Sixth Ave. SW, Suite 3800, Calgary, Alta., Canada T2P 3Y7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The objective of this report is to provide a review of the current scientific literature reflecting the present state of knowledge of the effects of acid deposition on soils and to relate that literature to the soils of Alberta. More specific objectives are: to describe and discuss present concepts of the nature of soil acidity, and the influ-

ences of acidity from both natural and man-made sources on soil attributes including pH, ion exchange properties, nutrient availabiity, biogeochemical cycling, and the solubility and availabillty of toxic chemical constituents, particularly aluminium; to describe the major soils of Alberta in terms of genesis and classification, chemical and physical properties, and their distribution and extent; and to evaluate the potential impact of the deposition of varying levels of acidic and acid-forming substances on agricultural and forest soils with emphasis on the potential changes in soil properties, effects on biogeochemical cycles and on the acid neutralizing capacity of soils. A semi-empirical model for predicting soil response to acidification was applied in this report to demonstrate possible impacts on Alberta soils. Simulations were carried out on 4 soil types; modelling results showed that the soils most likely to be strongly affected by acid deposition are coarse textured mineral soils with surface horizons which are already strongly acidic. Recommendations are made for further research, including modelling, improving the knowledge and information base about acid deposition impacts, and research into highly acid-sensitive soils, peatlands, and effects of fertilizer practices. Includes glossary. 259 refs., 23 figs., 47 tabs.

57495 **(CU/KC—8711) Acidic deposition and the environment: a literature overview.** Legge, A.H.; Crowther, R.A. (Calgary Univ., Alberta (Canada). Kananaskis Centre for Environmental Research). Nov 1987. 245p. (MICROLOG—88-00616). Acid Deposition Research Program, 150 Sixth Ave. SW, Suite 3800, Calgary, Alta., Canada T2P 3Y7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A comprehensive literature review is presented of the effects of acid deposition on the environment, with special reference to Alberta. An introduction to atmospheric chemistry and acid deposition processes begins this review. Separate sections are then given on the effects of acid deposition on specific areas: forests, including direct and indirect effects, canopy-pollutant interactions, interactive effects, timber harvesting, tree reproduction, and plant communities; agriculture, including foliar injury and direct foliar effects, and direct and combined effects of sulfur dioxide, nitrogen oxides, ozone, and dry and wet acids; geology and hydrogeology, including groundwater acidification and human impacts; surface water, including factors influencing surface water acidification, effects on aquatic biota, and acidification modelling; soils, including soil reactions, natural acidification, and nutrient availability; and soil microorganisms and microbially mediated processes, including oxidation and reduction reactions, and sulfur microbiology. A review is also made of numerical models of air pollutant exposure and vegetation response, and of acidic deposition in the Alberta context. 813 refs., 11 figs., 45 tabs.

57496 **(EPRI-EA—5976) Multiphase flow and transport models for organic chemicals: A review and assessment: Final report.** Abriola, L.M. (Electric Power Research Inst., Palo Alto, CA (USA); Michigan Univ., Ann Arbor (USA). Dept. of Civil Engineering). Sep 1988. 107p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89000244/JAW.

This study provides a review of the literature on multiphase flow and transport (MPFT) models of organic chemicals in the subsurface. Unlike water borne solutes, organic compounds can move in nonaqueous phase liquid mode or in gaseous phase form through the porous media. The literature reviewed indicated that MPFT models can be divided into three groups: (1) sharp interface models; (2) immiscible flow models which incorporate capillarity; and (3) models dealing with interphase mass transport. This literature review suggests that MPFT models for migration of organic compounds have several problems. A major modeling problem is the inaccurate representation of geochemical and biotic processes which control the release and transformation of chemicals in the waste and subsequently in the geological medium. In addition, data to use models are currently unavailable. Also the models are very costly to use. This report contains recommendations for future research on model development, validation, and application. 182 refs., 7 figs., 4 tabs.

57497 **(ORNL/TM—10750) Bioremediation of PCB-contaminated soil at the Y-12 Plant.** Donaldson, T.L.; Strandberg, G.W.; McGinnis, G.P.; Palumbo, A.V.; White, D.C.; Hill, D.L.; Phelps, T.J.; Hadden, C.T.; Revis, N.W.; Holdsworth, G. (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 52p. NTIS, PC A04/MF A01. Order Number DE89001335/JAW.

The technical feasibility of bioremediation of soils contaminated with polychlorinated biphenyls (PCBs) was investigated using six in-situ lysimeters and two slurry bioreactors during the summer and fall of 1987. Microbial degradation of PCBs was characterized, and microbial cultures were isolated and characterized. Indigenous microorganisms present in contaminated soils from the floodplain of Bear Creek were shown to be capable of degrading monochlorinated biphenyl. Evidence included production of radiolabeled carbon dioxide from radiolabeled substrate and microbial characterization using gene probes and signature lipid analyses. Evidence was also obtained for dechlorination of highly chlorinated PCBs under laboratory conditions by microbial cultures isolated from other contaminated soils. These results are quite encouraging for further development of bioremediation technologies for PCBs. In-situ treatment of the soils in lysimeters by aeration/mixing and water appeared to stimulate growth of microorganisms and increase the biodegradation of monochlorinated biphenyl in laboratory experiments using soil samples from the lysimeters. The effects of additional nutrients, carbon source, and inocula were unclear from these tests; only one condition for each parameter was tested in the limited number of lysimeters. 12 refs., 11 figs., 14 tabs.

57498 **(PB—88-231196/XAB) Estimating exposures to 2,3,7,8-TCDD. Draft report.** (Environmental Protection Agency, Washington, DC (USA). Office of Health and Environmental Assessment). Mar 1988. 360p. NTIS, PC A16/MF A01.

See also PB—88-231212.

This exposure assessment document provides a review and update of information related to exposure to 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). Several scenarios are constructed to illustrate how contaminated material from contaminated soil, various land-disposal situations, and municipal-waste incineration can result in exposure to 2,3,7,8-TCDD. Estimates are also provided to show what the human exposure and risk would be via inhalation, dermal contact, and ingestion of contaminated soil. Part One presents an update of previous work and an analysis of key issues related to exposure assessment for chlorinated dibenzo-p-dioxins with emphasis on 2,3,7,8-TCDD, such as the behavior of 2,3,7,8-TCDD in soil and sediment, bioavailability from soil, the use of pharmacokinetics for estimating 2,3,7,8-TCDD exposures, and plant uptake. Part Two addresses the application of exposure-assessment methods discussed in Part One, in evaluating 2,3,7,8-TCDD exposures from selected situations. Twenty different exposure scenarios, covering contaminated soil, landfills, and incineration are presented. Human exposure and risk calculations are then computed under each pathway for the different scenarios.

57499 **(PB—88-234042/XAB) Measurement of hydrolysis rate constants for evaluation of hazardous-waste land disposal. Volume 3. Data on 70 chemicals.** Ellington, J.J.; Stancil, F.E.; Payne, W.D.; Trusty, C.D. (Environmental Protection Agency, Athens, GA (USA). Environmental Research Lab.). Jul 1988. 29p. (EPA—600/3-88/028). NTIS, PC A03/MF A01.

See also PB—87-227344.

To provide input data for a mathematical model to estimate potential ground-water contamination from chemicals in land-disposal sites, hydrolysis rate constants were measured for 70 regulated chemicals under carefully controlled conditions. Hydrolysis rates were measured under sterile conditions at precisely controlled temperatures and at three hydrogen-ion concentrations (pH 3, 7, and 11). Conditions were adjusted to provide sufficiently precise rate constants to meet modeling requirements, as determined through model-sensitivity tests. In addition to precise control of temperature and pH, precautions were taken to minimize impact of adventitious processes. Chemical concentrations as a function of incubation time in the constant-temperature bath were measured by gas chromatography, liquid chromatography, or ion-exchange chromatography.

Identities and purities of the chemicals were determined by mass spectrometry, supplemented, in some cases, by infrared spectrometry. Four chemicals (DL-trans-4-chlorostilbene oxide, benzyl chloride, 2,4-dichlorophenoxyacetic acid methyl ester, and lindane) were used as standard reference compounds (SRCs) to ensure reproducibility of analytical operations and control of parameters that affect hydrolysis rates of chemicals in an aqueous environment.

57500 **(STF—21A87111) Accidentally spilled gas-oil in a shoreline sediment on Spitsbergen: Natural fate and enhancement of biodegradation.** Sveum, P. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Dec 1987. 19p. (CONF-8706190—1). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754900/JAW.

From 10. arctic and marine oilspill program seminar; Edmonton, Canada (9 Jun 1987).

The oil soluble fertilizer Inipol EAP22 has been used on shore as a treatment agent after an accidental marine gas oil contamination on Spitsbergen. A 60 % increase in the biodegradation of the aliphatic fraction was obtained as a maximum. Due to the high rate of physical self cleaning (about 90%) the importance of the biodegradation for the total self cleaning was limited. 13 drawings, 2 tables.

57501 **Degradation of polycyclic aromatic hydrocarbon compounds under various redox conditions in soil-water systems.** Mihelcic, J.R.; Luthy, R.G. (Carnegie Mellon Univ., Pittsburgh, PA (USA)). *Applied and Environmental Microbiology;* **54**: No. 5, 1182-1187(May 1988). Contract AC21-84FC10619.

Naphthol, naphthalene, and acenaphthene were degraded microbially under aerobic conditions from initial aqueous-phase concentrations of 9, 7, and 1 mg/lit to nondetectable levels in 3, 10, and 10 days, respectively. Under anaerobic conditions naphthol degraded to nondetectable levels in 15 days, whereas naphthalene and acenaphthene showed no significant degradation over periods of 50 and 70 days, respectively. Under denitrification conditions naphthol, naphthalene, and acenaphthene were degraded from initial aqueous-phase concentrations of 8, 7, and 0.4 ng/liter to nondetectable levels in 16, 45, and 40 days, respectively. Acclimation periods of approximately 2 days under aerobic conditions and 2 weeks under denitrification conditions were observed for both naphthalene and acenaphthene. Abiotic degradation of naphthalene and naphthol were evaluated by reaction with manganese oxide, a minor soil constituent. In the presence of a manganese oxide, naphthalene showed no abiotic degradation over a period of 9 weeks, whereas the aqueous naphthol concentration decreased from 9 mg/liter to nondetectable levels in 9 days. The results of this study show that low-molecular-weight, unsubstituted, polycyclic aromatic hydrocarbons are amenable to microbial degradation in soil-water systems under denitrification conditions.

57502 **Microbial degradation of acenaphthene and naphthalene under denitrification conditions in soil-water systems.** Mihelcic, J.R.; Luthy, R.G. (Carnegie Mellon Univ., Pittsburgh, PA (USA)). *Applied and Environmental Microbiology;* **54**: No. 5, 1188-1198(May 1988). Contract AC21-84FC10619.

This study examined the microbial degradation of acenaphthene and naphthalene under denitrification conditions at soil-to-water ratios of 1:25 and 1:50 with soil containing approximately 10^5 denitrifying organisms per g of soil. Under nitrate-excess conditions, both acenaphthene and naphthalene were degraded from initial aqueous-phase concentrations of about 1 and several mg/liter respectively, to nondetectable levels (<0.01 mg/liter) in less than 9 weeks. It was judged that the apparent acclimation period resulted from the time required for a small population of organisms capable of PAH degradation to attain sufficient densities to exhibit detectable PAH reduction, rather than being a result of enzyme induction, mutation, or use of preferential substrate. About 0.9% of the naturally occurring soil organic carbon could be mineralized under denitrification conditions, and this accounted for the greater proportion of the nitrate depletion. Mineralization of the labile fraction of the soil organic carbon via microbial denitrificaitonoccurred without an observed acclimation period and was rapid compared with PAH degradation. Under nitrate-limiting conditions the PAH compounds were stable owing to the depletion of nitrate via the more rapid process of soil organic carbon mineralization. Soil sorption tests showed at the initiation of a test that the total mass of PAH compound was divided in comparable proportions between solute in the aqueous phase and solute sorbed on the solid phase.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 56236, 56290, 56298, 56340, 57389

57503 (INIS-mf—11311, pp 7) **Radionuclides from the Chernobyl accident in soil over the Czechoslovak territory: their origin, deposition and distribution.** Bucina, I.; Dvorak, Z.; Malatova, I.; Ticha, H.; Drabova, D. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57504 **(NAGRA-NTB—80-05) Radionuclide transport of decay chains through heterogeneous geological media.** Hadermann, J.; Patry, J. (2314000CH). (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Jun 1980. 59p. (In German). Nagra, CH-5401 Baden, Switzerland.

A onedimensional radionuclide chain transport model is developed taking into account sorption, dispersion and arbitrary repository concentrations. For piecewise constant parameters a semianalytical solution can be written down when mass conservation is considered rigorously and flux conservation to a good approximation at the layer boundaries. The solution consists of a superposition of terms which are easily interpreted and is invariant under layer permutation and parameter scaling. A corresponding computer code RANCH has been developed. Its structure and some experience in numerical calculations are discussed. As an example the results of a three layer, four chain members calculation are given. (author) 36 refs., 8 figs., 16 tabs.

57505 **(OEFZS-A—1051) Cesium-activity concentration in milk to be expected in the year 1987/88.** Mueck, K.; Horak, O.; Gerzabek, M.; Haunold, E. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Strahlenschutz; Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Landwirtschaft). (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Aug 1987. 27p. (In German). (ST—148/87; LA—184/87). Austrian Research Centre Seibersdorf, A-2444 Seibersdorf, Austria.

Limited distribution.

In order to estimate the activity concentration to be expected in milk in the coming year (summer 1987 to spring 1988) 124 samples of grass, hay and silage of the first harvest 1987 were taken in the area of the four large drying mills in Austria and evaluated with regard to the content of /sup 134/Cs and /sup 137/Cs. The results of the measurements yield expected average activity concentrations in milk at approximately a fifteenth of the maximum values of 1986 or a sixth of the values in winter 1986/87. 4 refs., 1 fig., 5 tabs.

57506 **(PNL—6415-Rev.1) Hanford Site National Environmental Policy Act (NEPA) characterization.** Cushing, C.E. (ed.). (Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 236p. NTIS, PC A11/MF A01. Order Number DE89001461/JAW.

This document describes the Hanford Site environment (Chapter 4) and contains data in Chapter 5 and 6 which will guide users in the preparation of National Environmental Policy Act (NEPA)-related documents. Many NEPA compliance documents have been prepared and are being prepared by site contractors for the US Department of Energy, and examination of these documents reveals inconsistencies in the amount of detail presented and the method of presentation. Thus, it seemed necessary to prepare a consistent description of the Hanford environment to be used in preparing Chapter 4 of environmental impact statements and other

site-related NEPA documentation. The material in Chapter 5 is a guide to the models used, including critical assumptions incorporated in these models, in previous Hanford NEPA documents. The users will have to select those models appropriate for the proposed action. Chapter 6 is essentially a definitive NEPA Chapter 6, which describes the applicable laws, regulations, and DOE and state orders. In this document, a complete description of the environment is presented in Chapter 4 without excessive tabular data. For these data, sources are provided. Most subjects are divided into a general description of the characteristics of the Hanford Site, followed by site-specific information where it is available on the 100, 200, 300, and other Areas. This division will allow a person requiring information to go immediately to those sections of particular interest. However, site-specific information on each of these separate areas is not always complete or available. In this case, the general Hanford Site description should be used. 131 refs., 19 figs., 32 tabs.

5104 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 57506

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 56114, 56877

5106 Regulations

REFER ALSO TO CITATION(S) 56721

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

REFER ALSO TO CITATION(S) 56722, 57540

57507 **(CORR—88-258) Savannah River Cursory Surveys for E.I. du Pont de Nemours and Company, 1987.** (Academy of Natural Sciences of Philadelphia, PA (USA). Div. of Environmental Research). 18 Jul 1988. Contract AC09-76SR00001. 65p. NTIS, PC A04/MF A01. Order Number DE89000464/JAW.

The 1987 cursory surveys of algae, insect and fish communities of the Savannah River in the vicinity of the Savannah River Plant (SRP) were a continuation of long-term biomonitoring studies conducted on the river since 1951. Since the initial series of biological surveys carried out prior to the start of SRP operations, the Academy has performed comprehensive surveys at regular intervals, supplemented by quarterly cursory surveys during those years comprehensive surveys are not performed. The 1987 algae and fish studies indicate no differences in water quality among stations, or in comparison with recent years, whereas the insect study found evidence of reduced water quality in 1987 at Station 1 above the SRP and an improvement in water quality overall in this reach of the river in recent years. 29 refs., 5 figs., 18 tabs.

57508 **(DPST—88-707) A review of abiotic and biotic interactions in pelagic communities: Processes relevant to L Lake.** Bowers, J.A. (Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 48p. NTIS, PC A03/MF A01. Order Number DE89000007/JAW.

The purpose of this report is to provide a state-of-the-art review of structural and functional processes in pelagic communities and extrapolate these empirical and theoretical results to L Lake, the once-through cooling reservoir at the Savannah River Plant. Man-made reservoirs differ from natural lakes in their origins, hydrodynamics, sedimentation patterns, and general eutrophication histories. Phosphorus and nitrogen limitation of phytoplankton productivity controls the rate of eutrophication, while also determining algal community structure. Here the Lean and Monod models of nutrient fluxing and uptake kinetics provide useful constructs for predictive purposes. Much of the reduced carbon synthesized by primary production is shunted through the microbial loop where heterotrophic flagellates and protozoans pass this carbon on to the macrozooplankton. This recently discovered pathway is common to eutrophic reservoirs where blue-green species dominate phytoplankton assemblages. Through selective grazing and tactile oriented predation, the crustacean zooplankton partially regulates the relative abundance of algae and microzooplankton species. 194 refs., 10 figs.

57509 **(TR-EL—86-2-Rev./88(23)) Life history and environmental requirements of loggerhead turtles.** Nelson, D.A. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Environmental Lab.). Aug 1988. 43p. Unlimited audience, publicly available. Fish and Wildlife Service, 1010 Gause Blvd, Slidell, LA 70458. Order Number TI89000490/JAW.

In the United States scattered nestings of loggerhead sea turtles (Caretta caretta) may occur in most of its range from Texas to Florida and Florida to New Jersey; however, nesting concentrations occur on coastal islands of North Carolina, South Carolina, and Georgia and on the coasts of Florida. The greatest portion of a loggerhead's life is spent in ocean and estuarine waters where it breeds in shallow waters adjacent to nesting beaches, feeds on a variety of fish and shellfish, and migrates generally north in the spring and summer and south in the fall and winter. The other part of its life is spent on coastal beaches where the female digs a nest, lays her eggs (average 120 eggs), the eggs hatch (in 46 to 65 days), and the hatchlings emerge from the nest as a group and orient seaward to become part of the aquatic system again. Nesting activity begins in the spring, peaks in midsummer, and declines until completion in late summer. A loggerhead female generally nests every other or every third year. Beach sand temperatures may affect nest site selection by females, the incubation time and hatching success of eggs, and the sex and emergence timing of hatchlings. Most management of sea turtles has been directed toward increasing hatching and hatchling success through predator control, egg relocation, and raising captive hatchlings. 183 refs.; 10 figs.; 3 tabs.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 56115, 56116, 56117, 56118, 56267, 56297, 56720, 56882, 57453, 57464, 57492, 57495, 57496, 57499, 57501, 57502, 57506, 57542, 57602, 57607, 57610, 57611, 57664

57510 **(AD-A—194788/6/XAB) Low chemical concentration and pH as factors limiting the success of inoculation to enhance biodegradation.** Zaidi, B.R.; Stucki, G.; Alexander, M. (Cornell Univ., Ithaca, NY (USA). Dept. of Agronomy). 1988. 10p. NTIS, PC A02/MF A01.

Pub. in Environmental Toxicology and Chemistry, Vol. 7, 143-151(1988).

A strain of Pseudomonas that mineralized 1 microgram of p-nitrophenol (PNP) per milliliter in culture failed to mineralize the compound in nonsterile or sterile lake water. The bacterium did not act on PNP at the pH of the lake water (pH 8.0) or in culture medium at the same pH, although it did mineralize PNP when added to sterile lake-water samples adjusted to pH 7.0. A second strain of Pseudomonas that grew and mineralized 1 micro PNP/ml in culture at pH 8.0 and in sterile lake water at pH 7.0 neither mineralized nor grew on PNP in sterile lake water at pH 8.0 but failed to enhance mineralization when added to nonsterile lake water at that pH. Corynebacterium sp. grew on and mineralized 1 micro PNP/ml in culture medium and in sterile lake water, and its inoculation into nonsterile lake water greatly reduced the time for the mineralization of 1.0 and 0.1 micro PNP/ml.

57511 **(AD-A—194900/7/XAB) Installation Restoration Program. Phase 2. Confirmation/quantification. Stage 3. Final report, July 1986-February 1988.** (AeroVironment, Inc., Monrovia, CA (USA)). 5 Feb 1988. 921p. (AV-FR—86/596). NTIS, PC A99/MF E04.

Includes envelopes with 3 maps.

AeroVironment Inc. conducted a Phase II, Stage 3 IRP Survey at Mather AFB in Sacramento, California. The objective of this survey was to confirm and quantify the presence and extent of

contamination at the 7100 Disposal Area, Air Command and Warning (ACW) Area Disposal Site, West Ditch and in the Northeast Perimeter of the base. These sites had been invesigated in 1985 during a Phase II, Stage I Survey and additional work was recommended for all four. During Stage 3, thirty-five groundwater monitoring wells were installed, using standard mud rotary techniques. Seventeen were drilled into the water table aquifer and 18 into the confined aquifer. Two rounds of groundwater samples were collected from 35 Stage 3 wells, 1 Stage 2 well, and 8 Stage 1 wells. One round of samples was collected from base production wells. A geophysical survey and a soil gas survey were also conducted at the ACW and 7100 sites.

57512 **(AD-A—194970/0/XAB) Installation-Restoration Program. Phase 2. Confirmation/quantification. Stage 1. Problem confirmation study: Selfridge Air National Guard Base, Macomb County, Michigan. Volume 1. Final technical report, November 1984-October 1986.** Dowden, J.E.; Ricketts, H.M.; Sheedy, K.A. (Weston (Roy F.), Inc., West Chester, PA (USA)). Oct 1986. 171p. NTIS, PC A08/MF A01.

See also Volume 2, AD-A194 971.

A problem-confirmation study was performed at seven sites on Selfridge ANGB identified in the Phase I investigation as requiring further study (Southwest Sanitary Landfill, Fire Training Area 2, Fire Training Area 1, West Ramp Fuel Spill Site, Tucker Creek Landfill, Northwest Landfill, and East Ramp Fuel Spill Site). The field investigation was conducted from November 1984 to July 1985 and included installation of 25 monitor wells, collection and analysis of ground-water samples from the monitor wells, and collection and analysis of soil samples from the West and East Ramp Sites. Analytes included VOA, TOC, phenols, COD, cadmium, chromium, copper, lead, nickel, zinc, petroleum hydrocarbons, oil and grease, EP toxicity, and ignitibility. Based on the hydrogeologic complexity of the physical setting and the findings of the sampling and analytical work, follow-on investigations were recommended at all seven sites.

57513 **(AD-A—194971/8/XAB) Installation-Restoration Program. Phase 2. Confirmation/quantification. Stage 1. Problem confirmation study: Selfridge Air National Guard Base, Macomb County, Michigan. Volume 2. Final technical report, November 1984-October 1986.** Dowden, J.E.; Ricketts, H.M.; Sheedy, K.A. (Weston (Roy F.), Inc., West Chester, PA (USA)). Oct 1986. 535p. NTIS, PC A23/MF A01.

See also Volume 1, AD-A194 970.

The purpose of this task is to undertake a field investigation at Selfridge ANGB MI to: (1) determine the presence or absence of contamination within the specified areas of investigation; (2) if contamination exists, determine the potential for migration of those contaminants in the various environmental media; (3) identify potential environmental and health-risk consequences of migrating discovered pollutants; and (4) identify additional investigations necessary to determine the magnitude, extend, direction, and rate of migration of discovered contaminants.

57514 **(AD-A—194972/6/XAB) Installation-Restoration Program. Phase 2. Confirmation/quantification. Stage 1. Problem confirmation study: Otis Air National Guard Base, Massachusetts, Air National Guard Support Center, Andrews Air Force Base, Maryland. Final technical report, November 1983-July 1985.** Kraybill, R.L.; Smart, G.R.; Bopp, F. (Weston (Roy F.), Inc., West Chester, PA (USA)). 4 Sep 1985. 140p. NTIS, PC A07/MF A01.

A Problem Confirmation Study was performed at seven sites on Otis Air National Guard Base: the Current and Former Training Areas, the Base Landfill, the Nondestructive Inspection Laboratory, the Fuel Test Dump Site, the Railyard Fuel Pumping Station, and the Petrol Fuel Storage Area. The field investigation was conducted in two stages, in November 1983 through January 1984, and in October through December 1984. Resampling was performed at selected locations in April and July 1985. A total of 11 monitor wells were installed and sampled and test-pit investigations were conducted at six sites. In addition, the contents of a sump tank, and two header pipes for fuel-transmission lines were sampled. Analytes included TOC, TOX, cyanide, phenols, Safe Drinking Water metals, pesticides and herbicides, and in the second round, priority-pollutant volatile organic compounds and a GC fingerprint scan for fuel products. On the basis of the field-work findings, it is concluded that, to date, water-quality impacts on ground water from past activities have been minimal.

57515 **(AD-A—194988/2/XAB) Predicting product water quality from the 600-gallon-per-hour reverse-osmosis water-purification unit. Field water supply on the winter battlefield. Special report.** Bouzoun, J.R. (Army Cold Regions Research and Engineering Lab., Hanover, NH (USA)). Feb 1988. 12p. (CRREL-SR—88-2). NTIS, PC A03/MF A01.

A preliminary equation for predicting the total dissolved solids (TDS) concentration in the product water from the 600-gph ROWPU is presented. The equation requires the raw water temperature and TDS concentration as input data. Both of these variables can be easily measured in the field. The equation is presently limited to raw-water TDS concentrations in the range of 800-900 mg/L. As data become available for a greater range of raw-water TDS concentrations, including seawater, the equation will be modified. The standard error of the estimate is 3.4 mg/L.

57516 **(AD-A—195101/1/XAB) Prototype technology for monitoring volatile organics. Volume 2. Final report, August 1984-November 1987.** Taylor, V.; Wander, J. (S-Cubed, San Diego, CA (USA)). Mar 1988. 119p. (SSS-R—87-8515-VOL-2). NTIS, PC A06/MF A01.

See also Volume 1, AD-A195 120.

This report describes the development and implementation of the phase I prototype volatile organic compound (VOC) monitor, a turn-key system for analyzing trichloroethylene (TCE) in water. The system incorporates commercial purge and trap and gas chromatography instruments, a microcomputer, and custom-written software. Because this monitor is planned for installation at base facilities and for use by nonspecialized personnel, driving design considerations were reliability and simplicity of operation. Assembly and lab testing of the unit were completed in September 86, and the monitor was transitioned to the sewage plant (379 CES/DEMH) at Wurtsmith AFB MI for evaluation by base personnel. Most logistical accomodations had been made within 6 months, and, except for one construction related accident, the system worked exactly as planned. Companion documents, including schematics and operating and maintenance instructions, are included in Vol. 1; Vol 2 is a complete downlisting of the software.

57517 **(AD-A—195120/1/XAB) Prototype technology for monitoring volatile organics. Volume 1. Final report, August 1984-November 1987.** Taylor, V.; Wander, J. (S-Cubed, San Diego, CA (USA)). Mar 1988. 143p. (SSS-R—87-8515-VOL-1). NTIS, PC A07/MF A01.

See also Volume 2, AD-A195 101.

This report describes the development and implementation of the phase I prototype volatile organic compound (VOC) monitor, a turn-key system for analyzing trichloroethylene (TCE) in water. The system incorporates commercial purge and trap and gas-chromatography instruments, a microcomputer, and custom-written software. Because this monitor is planned for installation base facilities and for use by nonspecialized personnel, driving design considerations were reliability and simplicity of operation. Assembly and lab testing of the unit were completed in September 86, and the monitor was transitioned to the sewage plant (379 CES/DEMH) at Wurtsmith AFB MI for evaluation by base personnel. Most logistical accommodations had been made within 6 months, and, except for one construction related accident, the system worked exactly as planned. Companion documents, including schematics and operating and maintenance instructions, are included in Vol. 1; Vol 2 is a complete downlisting of the software.

57518 **(AD-A—195345/4/XAB) Impact of household hazardous wastes on landfill leachates. Master's thesis.** Gapinski, D.P. (Rensselaer Polytechnic Inst., Troy, NY (USA)). May 1988. 51p. NTIS, PC A04/MF A01.

Protective measures have been enacted to mitigate the deleterious effects of landfill leachate on ground and surface waters. One such measure has been to remove items classified as Household

Hazardous Wastes from the solid-waste stream prior to landfill disposal. Even though the alternative methods of disposal may be very costly, no effort has been made to assess the impact of Household Hazardous Wastes on landfill leachates and, subsequently, on receiving waters. Therefore, a model is needed to assess this impact accurately and determine which, indeed if any, items should be removed from the solid-waste stream prior to landfill disposal. The model proposed to assess the impact of Household Hazardous Wastes is developed in two steps.

57519 **(CU/KC—8702) Pollutant exposure and response relationships: a literature review. Geological and hydrogeological aspects.** Campbell, K.W. (Calgary Univ., Alberta (Canada). Kananaskis Centre for Environmental Research). Feb 1987. 174p. (MICROLOG—88-00577). Acid Deposition Research Program, 150 Sixth Ave. SW, Suite 3800, Calgary, Alta., Canada T2P 3Y7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A review of the literature on acid depositional effects on groundwater, with specific reference to the geology and hydrology of Alberta, is presented. Topics reviewed include acidification processes, evidence for groundwater acidification, pH buffering mechanisms, and the roles of groundwater hydrology and the major cations and anions. A hydrogeological resource inventory of Alberta is also included. It is concluded that there is a reasonable scientific basis for concern about the impact of atmospheric pollution on groundwater resources. In Canada, although there is no conclusive evidence of groundwater acidification from acid deposition, Ontario studies conclude that, given sufficient atmospheric loading over a long enough period, changes in groundwater chemistry would occur. In Alberta, groundwater resources are used extensively, and any changes in groundwater chemistry could have a dramatic effect on groundwater users. The geochemical processes that cause groundwater acidification are complex; extrapolation of results of studies in Sweden and the eastern USA is tenuous because of significant differences in physical setting. In Alberta, groundwaters are characterized by relatively high pH, and much of the province is covered by thick deposits of glacial till that has a high acid neutralization capacity. Aquifers in Alberta that are most likely to show documentable response to acid deposition would be those having low buffering capacity, rapid recharge, shallow short flow regime, and high permeability. 336 refs., 49 figs., 16 tabs.

57520 **(CU/KC—8702) Surface water acidification literature review. Vol. 1.** Telang, S.A. (Calgary Univ., Alberta (Canada). Kananaskis Centre for Environmental Research). Feb 1987. 126p. (MICROLOG—88-00571). Acid Deposition Research Program, 150 Sixth Ave. SW, Suite 3800, Calgary, Alta., Canada T2P 3Y7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report assesses the state of scientific knowledge on the effects on acidic atmospheric deposition on surface water chemistry. There appear to be two views on the mechanism of surface water acidification: that it is caused by the long-range atmospheric transport and deposition of acidic substances, or by internal generation of hydrogen ions in watersheds. The main findings of the literature review are as follows. Uncontaminated precipitation can have pH levels below 5.6. Some surface waters are naturally acidic. Quantity and quality of atmospheric deposition and atmospheric events can increase hydrogen ion concentration in surface waters. Internal generation of hydrogen ions in watersheds and their input to surface waters can be many times greater than input from atmospheric sources. Surface water susceptibility to acidification depends on factors including bedrock geology, soil type, topography, land use practices, and climatic/meteorological conditions. In North America, trends of decreasing surface water pH have been observed in Ontario, Nova Scotia, the Adirondacks, and northern New England. Comparison of historical with recent data needs to be viewed cautiously; problems are associated with use of more than 2 different methods of data comparison and with inferring trends. There are conflicting data on response to aquatic biota to acidification, yet a number of effects have been well documented. Numerous models have been developed to evaluate effects of acid deposition on surface water quality; however, most of these assume acidification is caused by atmospheric deposition of sulfuric acid alone. 381 refs., 7 figs., 6 tabs.

57521 **(DP-MS—86-12) Monitoring for volatile organics in effervescent ground water.** Fay, W.; Lorenz, R.; Jones, V.; Colven, W.; Looney, B. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1988. Contract AC09-76SR00001. 10p. (CONF-881184—1). NTIS, PC A02/MF A01. Order Number DE88016909/JAW.

From Conference on petroleum hydrocarbons and organic chemicals in ground water; Houston, TX, USA (9 Nov 1988).

Water from aquifers under pressure and saturated in nitrogen, carbon dioxide, hydrogen, or other gases effervesces at atmospheric pressure. This effervescence removes volatile organics, causing water exposed to atmospheric pressure to be unrepresentative of the ground water. The results of any sampling method that exposes the water to the atmosphere are distorted no matter how carefully the sample is collected. Appropriate samples can be collected using down-hole samplers that are retrieved without exposure to the atmosphere or using bomb samplers for pumping wells. Du Pont at the Savannah River Plant has developed the Chismar sampler, which is an appropriate bomb sampler. The sampling device is a steel tube with gas-tight ball valves at either end. When the ball valves are open, the sampler has a uniform 0.5-in. diameter interior that allows unobstructed flow of water through the device. Water is pumped through the sampler to reach equilibrium; then the valves are closed simultaneously, capturing a representative sample of the gas and water. The organics and gases are purged from the sampler into an inflatable sample container. Aliquots of the gas are analyzed by gas chromatography. 6 refs., 2 figs.

57522 **(DPST—88-346) Research study on horizontal well drilling and in-situ remediation: Final program plan.** Kaback, D.S.; Looney, B.B. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 22 Feb 1988. Contract AC09-76SR00001. 24p. NTIS, PC A03/MF A01. Order Number DE89000010/JAW.

Vacuum extraction and air-stripping are new technologies that have broad applications at sites of volatile organic contaminated soils and groundwater. These types of sites are very common across the United States. A research study to test the combined effect of both technologies in an in-situ setting is planned. Vacuum extraction has been demonstrated as an effective technique to remediate the vadose zone both at SRP and at numerous sites across the country. Air stripping has also been demonstrated as an effective technique in an above-ground setting at SRP and across the country. However, to our knowledge it has not been tested as an in-situ method. The proposed research is on the leading edge of groundwater/vadose zone remediation technology and has great potential to impact available technology in this field. 3 refs., 13 figs., 1 tab.

57523 **(DPST—88-747) Capital costs of lime treatment at the Augusta wastewater treatment plant.** Halverson, N.V. (Savannah River Lab., Aiken, SC (USA)). 17 Aug 1988. Contract AC09-76SR00001. 7p. NTIS, PC A02/MF A01. Order Number DE89001418/JAW.

The capital costs were estimated for the addition of lime treatment facilities to the Augusta sewage treatment plant as a means of reducing the phosphorus loading of L Lake and consequently reducing the algae populations in the lake. Primary lime treatments and tertiary lime treatments were considered. The capital cost of a primary lime treatment addition would be lower than for a tertiary treatment addition. Depending on whether the existing primary settling tank can be utilized for lime treatment or a new clarifier must be built, a primary lime treatment addition would currently cost between $500,000 and $3 million to construct at the Augusta sewage treatment plant. Primary lime treatment coupled with the existing activated sludge biological treatment system would remove approximately 80% of the phosphorus from the sewage entering the sewage treatment plant, resulting in an effluent concentration of about 2 mg/l. To reduce effluent phosphorus concentration to 1 mg/l or less, additional coagulation and effluent filtration facilities would be necessary. One disadvantage of primary lime treatment, however, would be the two-fold or three-fold increase in sludge to be disposed. Tertiary lime treatment usually results in lower effluent phosphorus levels than primary lime treat-

ment, but the capital cost is significantly higher. Costs for tertiary lime treatment for the Augusta sewage treatment plant would range from $5 million to $14 million. The higher estimate would include an additional settling stage and filtration of the effluent, features which would improve the efficiency of phosphorus removal and reduce the effluent phosphorus concentration. 12 refs.

57524 **(PB—88-220504/XAB) CORMIX1: an expert system for mixing-zone analysis of toxic and conventional, single-port aquatic discharges.** Doneker, R.L.; Jirka, G.H. (Cornell Univ., Ithaca, NY (USA). Dept. of Environmental Engineering). Jun 1988. 367p. NTIS, PC A16/MF A01.

An expert system, CORMIX1, was developed to predict the dilution and trajectory of a single buoyant discharge into an unstratified aquatic environment with and without crossflow. The system uses knowledge and inference rules obtained from hydrodynamic experts to classify and predict buoyant jet mixing. CORMIX1 gathers the necessary data, checks for data consistency, assembles and executes the appropriate hydrodynamic simulation models, interprets the results of the simulation in terms of the legal requirements including toxic discharge criteria, and suggests design alternatives to improve dilution characteristics. The results of the hydrodynamic simulation are in good to excellent agreement with field and laboratory data. In particular, CORMIX1 correctly predicts highly complex discharge situations involving boundary interactions and buoyant intrusions, a result not predicted by other currently available initial mixing models.

57525 **(PB—88-230628/XAB) Protecting ground water: pesticides and agricultural practices. Technical report (Final).** (Environmental Protection Agency, Washington, DC (USA). Office of Ground-Water Protection). Feb 1988. 84p. (EPA—440/6-88/001). NTIS, PC A05/MF A01.

The booklet presents the results of a project conducted by EPA's Office of Ground-Water Protection to evaluate the potential impacts of various agronomic, irrigation, and pesticide application practices on ground water. The report provides State and local water quality and agricultural officials with technical information to help in the development of programs to protect ground water from pesticide contamination. The report explains the principles involved in reducing the risk of pesticide contamination and describes what is known about the impact of various agricultural practices on pesticide leaching. It is hoped that the information will be helpful to water-quality officials in developing and implementing groundwater protection programs.

57526 **(PB—88-231394/XAB) Progress report: long-term benthic monitoring and assessment program for the Maryland portion of Chesapeake Bay (July 1986-October 1987).** (Versar, Inc., Columbia, MD (USA)). May 1988. 1250p. NTIS, PC E99.

Set includes PB—88-231402 through PB—88-231428.

A separate abstract is included for the 3 reports of this set.

57527 **(PB—88-231402/XAB) Progress report: long-term benthic monitoring and assessment program for the Maryland portion of Chesapeake Bay (July 1986-October 1987). Volume 1. Text.** Holland, A.F.; Shaughnessy, A.T.; Scott, L.C.; Dickens, V.A.; Ranasinghe, J.A. (Versar, Inc., Columbia, MD (USA)). May 1988. 334p. NTIS, PC A15/MF A01.

See also Volume 2, PB—88-231410; Also available in set of 3 reports PC E99, PB—88-231394.

The long-term benthic monitoring and assessment study for the Maryland portion of Chesapeake Bay is an integral component of the interdisciplinary Chesapeake Bay monitoring and assessment program. The major long-term objectives of the program are to: (1) determine the effectiveness of Baywide pollution abatement programs; (2) measure the cumulative, long-term impacts of power plant operations on Bay benthic resources; and (3) assess the status and trends for Bay water quality and biological resources. Sampling of benthic communities, sediments, and water quality was conducted from July 1, 1984 through December 1987 at 70 stations in the Maryland portion of the Chesapeake Bay and its tributaries.

57528 **(PB—88-231410/XAB) Progress report: long-term benthic monitoring and assessment program for the Maryland portion of Chesapeake Bay (July 1986-October 1987). Volume 2. Appendices A-Z.** Holland, A.F.; Shaughnessy, A.T.; Scott, L.C.; Dickens, V.A.; Ranasinghe, J.A. (Versar, Inc., Columbia, MD (USA)). May 1988. 498p. NTIS, PC A21/MF A01.

See also Volume 1, PB—88-231402 and Volume 3, PB—88-231428; Also available in set of 3 reports PC E99, PB—88-231394.

This report includes water-quality parameters measured at intervals from surface to bottom at benthic monitoring stations in Chesapeake Bay from April 1986 - December 1987. Species abundances are summarized by region in the study.

57529 **(PB—88-231428/XAB) Progress report: long-term benthic monitoring and assessment program for the Maryland portion of Chesapeake Bay (July 1986-October 1987). Volume 3. Appendices AA-KK.** Holland, A.F.; Shaughnessy, A.T.; Scott, L.C.; Dickens, V.A.; Ranasinghe, J.A. (Versar, Inc., Columbia, MD (USA)). May 1988. 419p. NTIS, PC A18/MF A01.

See also Volume 2, PB—88-231410; Also available in set of 3 reports PC E99, PB—88-231394.

The report includes species abundances of benthos collected at intervals from different sites of the Chesapeake Bay in Maryland.

57530 **(PB—88-232574/XAB) Protection of ground and surface waters, January 1982-August 1987: Citations from AGRICOLA (Agricultural Online Access) concerning diseases and other environmental considerations. Final report.** Bebee, C.N. (National Agricultural Library, Beltsville, MD (USA)). Jul 1987. 922p. (USDA/BLA—63). NTIS, PC A99/MF E04.

The citations in this bibliography are selected from English-language material from the international literature on the agricultural aspects of the pollution of ground and surface water by chemicals. Some of the subject areas include: Agricultural operations; Pesticides; Legislation; Land use; Urban hydrology and pollution; Food processing wastes; and Waste treatment.

57531 **(PB—88-867593/XAB) Hazardous materials: microbiological decomposition, January 1978-August 1988 (Citations from the Life Sciences Collection data base). Report for January 1978-August 1988.** (National Technical Information Service, Springfield, VA (USA)). Aug 1988. 190p. NTIS PC N01/MF N01.

Supersedes PB—87-865895.

This bibliography contains citations concerning the decomposition of toxic materials by microorganisms. Organisms that digest hydrocarbons, petroleum, cyanide, and dioxin are discussed. Population studies of fungi and bacteria that decompose hazardous materials are included. Rates of decomposition, the presence of these microorganisms in the soil and in water, products generated from hazardous materials decomposition, and the use of these products by other microorganisms are among the topics discussed. (This updated bibliography contains 360 citations, 16 of which are new entries to the previous edition.)

57532 **(PB—88-867874/XAB) Ozonization used in water and sewage treatment, January 1970-August 1988 (Citations from the NTIS data base). Report for January 1970-August 1988.** (National Technical Information Service, Springfield, VA (USA)). Aug 1988. 135p. NTIS PC N01/MF N01.

Supersedes PB—87-850814.

This bibliography contains citations concerning the utilization of ozone for the purification of industrial waste water, sewage, and drinking water. Topics include laboratory and field investigations of ozone-purification techniques alone, and in combination with other treatment methods. Some attention is given to toxic effects of products resulting from ozone treatment of sewage and waste waters. (This updated bibliography contains 208 citations, 30 of which are new entries to the previous edition.)

57533 (UCID—21342) Well log report for the Lawrence Livermore National Laboratory (LLNL) Ground Water Project, 1984-1987. Qualheim, B.J.; Boyd, P.; Wright, B. (eds.). (Lawrence Livermore National Lab., CA (USA)). Jun 1988. Contract W-7405-ENG-48. 397p. NTIS, PC A17. Order Number DE89001426/JAW.

This report presents all of the hydrogeologic well logs prepared through 1987 for the Lawrence Livermore National Laboratory (LLNL) Ground Water Project in the vicinity of the Livermore site. It also illustrates the use of a microcomputer to reduce and present geologic data for a ground water investigation. Brief summaries of LLNL site geology and Ground Water Project history are included here to add perspective for the discussion of how to tailor and run the well log generating software, and as background for the well logs themselves, which comprise the bulk of this report (Appendix A). The report presents details about how commercial well log generating software was modified for project purposes, describes the hardware used, explains input to the LLNL computer-aided design (CAD) system database, and shows current output from the CAD system. We plan to use CAD and the well log database in the future to directly produce cross sections and fence diagrams. In conclusion, we found that a microcomputer and commercially available geologic software programs can economically facilitate the production of well logs and can be an important tool in the presentation of information to regulatory agencies. The cost of producing report-quality well logs in the way described in this report is approximately one-quarter that of conventional hand drafting. 12 refs., 4 figs.

57534 Adsorption and desorption of dinitrotoluene on activated carbon. Ho, P.C.; Daw, C.S. (Oak Ridge National Lab., TN (USA)). *Environmental Science and Technology;* **22**: No. 8, 919-924(Aug 1988). Contract AC05-84OR21400.

The adsorption of 2,4-dinitrotoluene (DNT) in aqueous solution by two commercial activated carbons and desorption of DNT from these adsorbents by solvent extraction were studied. Both carbons proved to be excellent adsorbents for the removal of DNT from aqueous solution. The solvents tested for extracting the adsorbed DNT were water, acetone, methanol, and mixtures involving these solvents. Acetone and methanol are both effective solvents for the removal of DNT from spent carbons, while acetone is the most effective solvent on removal of chemicals (produced during the adsorption) other than DNT. Analysis of the solvent extracts revealed that in the solution, besides DNT, at least six other chemicals were present. Four of the chemicals were identified as 2,4-dinitrobenzyl alcohol, 2,4-dinitrobenzaldehyde, 2,4-dinitrobenzoic acid, and 2,4-dinitrobenzoate. The presence of these compounds suggests that after DNT absorption chemical reactions, such as oxidation, occurred.

57535 An investigation of two homologous series of carboxylic acids in Black Trona Water from the Green River Basin. Branthaver, J.F.; Thomas, K.P.; Logan, E.R.; Barden, R.E. (Western Research Institute, P.O. Box 3395, University Station, Laramie, WY (US)). *Fuel Science and Technology International;* **6**: No. 5, 525-540(1988).

Two series of carboxylic acids were identified in the dialysate from a sample of Black Trona Water from the Green River Basin of Wyoming. One of the series consists of straight-chain dicarboxylic acids ranging in carbon number from four to fourteen. This series had been observed by previous workers. The other series, much less abundant than the dicarboxylic acids, appears to be a series of homologous tricarboxylic acids that are derivatives of succinic acid. The structures of these compounds were determined by analysis of the mass spectra of their methyl esters and trideuteromethyl esters. Definitive biological precursors of this unusual class of compounds could not be assigned.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 56267, 56290, 56297, 56336, 57506

57536 (AERE-R—11734) Studies of environmental radioactivity in Cumbria. Part 11. Modelling the dispersion of radionuclides in the Irish sSa. Howorth, J.M.; Kirby, C.R. (UKAEA Harwell Lab. Environmental and Medical Science Div.; CAP Scientific Ltd., London (UK)). (UKAEA Harwell Lab. Environmental and Medical Science Div.; Department of the Environment, London (UK)). Mar 1988. 123p. (DOE-RW—88.058). H.M. Stationery Office, London, price Pound 7.00.

A 2-dimensional numerical model has been developed to investigate the dispersion of radionuclides, discharged from Sellafield, through the Eastern Irish Sea. The model is able to give good agreement with measured levels of dissolved /sup 137/Cs over a period of 14 years and also with measured levels of deposited sup(239+240)Pu. Validation of model results has been performed by a comparison of calculated and measured concentration of /sup 241/Am, good agreement being found with measurements of /sup 241/Am both dissolved in seawater and deposited on the seabed. (U.K.).

57537 (DPST—86-503) Summary of groundwater flow direction and velocity in the general separations area. Scott, M.T. (Savannah River Lab., Aiken, SC (USA)). 18 Jun 1986. Contract AC09-76SR00001. 19p. NTIS, PC A03/MF A01. Order Number DE89000471/JAW.

GeoTrans data from the model of groundwater flow and contaminant transport in the central portion of the Savannah River Plant (General Separations Area) was used to compute groundwater flow direction and velocities. This report describes the modeling area, shows method of computations, and illustrates the results in figure form. 1 ref., 12 figs., 2 tabs.

57538 (IAEA-R—3491-F) Study of the behaviour of radioactive cobalt in the coastal environment. Final report for the period August 1983 - December 1987. Hansen, A.M. (Universidad Nacional Autonoma de Mexico, Mexico City (Mexico). Inst. de Ciencias del Mar y Limnologia). (International Atomic Energy Agency, Vienna (Austria)). May 1988. 74p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88703965/JAW.

Mineral surfaces play an important role in regulating the concentrations of dissolved radionuclides and other trace elements in natural water systems. In bulk sediments, the different minerals present may exhibit completely different uptake mechanisms, and compete simultaneously for the same radionuclide. This study examines the adsorption behaviour of radiocobalt in two natural sediments collected in the coastal area adjacent to the Laguna Verde Nuclear Power Plant Site in Vera Cruz, Mexico. These sediment samples provided a complex substrate for trace metal removal, as shown by their different physical, chemical and mineralogical properties. Radiocobalt partitioning between these sediments and solution was determined using an isotope dilution technique, with Co-57 as the tracer. The uptake experiments were done under controlled conditions to determine the effects of pH, ionic strength, sediment binding site concentration, and mineral composition on Co adsorption. The experimental work included both time-dependent and equilibrium studies of Co partitioning. The time-dependent studies revealed two different rates (and hence processes) responsible for the removal of Co onto the sediments: a relatively fast initial reaction (complete within one week) which appears to be due to uptake on non-carbonate surface (perhaps oxide surfaces), and a slower rate of uptake (reaching equilibrium within 60 d or more) due to the formation of solid solutions of Co on calcite surfaces. The sorption of Co decreased as the ionic strength increased. In seawater, it appears that Mg ions suppress radiocobalt sorption (particularly during the fast uptake step), perhaps by decreasing the number of available binding sites on the sediments. The results of these uptake studies were modeled successfully using the triple layer-surface complexation model.

57539 **(NAGRA-NTB—84-21) Property of deep groundwaters in central north Switzerland and adjacent regions.** Schmassmann, H.; Balderer, W.; Kanz, W.; Pekdeger, A. (Geologisches Buero Dr. H. Schmassmann, Liestal (Switzerland); Bern Univ. (Switzerland). Physikalisches Inst.; Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland); Kiel Univ. (Germany, F.R.). Geologisch-Palaeontologisches Inst. und Museum). (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Aug 1984. 394p. (In German). Nagra, CH-5401 Baden, Switzerland.

The first part of this report introduces the programme of investigations used by Nagra since 1981 to examine regionally the properties of the deep groundwaters in Northern Switzerland and adjacent areas. The data of this programme provide a regional information system for the waters punctually found in the deep borings of Nagra. A review of the sampling points and the methods of data collection are presented. The investigations were conducted to define the physical properties of the water, the dissolved and undissolved components including microorganisms in the water, and the isotopic composition of the water and its components. The electronic data processing described in the report includes plausibility checks, graphical representations, correlation calculations, multivariate analyses and thermodynamic models. Preliminary interpretations of the available investigation results and the analysis from the deep boring programme are discussed. Hydrogeologic interpretation is given for the stable isotopes in the water and in the dissolved sulphates. Classification of the waters according to their principal components is discussed as well as the aquifer formations. Waters of different origins can be distinguished by principal and accessory components, by the relationships and correlations among water components as well as by multivariate methods, mainly cluster-analysis. In this way hydrologic connections between aquifers from different formations may be recognized. Information regarding water retention time in the subsurface is based on determinations of tritium, argon-39 and carbon-14 (with respect to carbon-13). Relationships within the major geological structures and conclusions with regard to the hydrogeologic synthesis of the deep groundwater flow regimes of Northern Switzerland, of particular importance to hydrodynamic modelling are considered. 129 refs., 70 figs., 91 tabs.

57540 **(ORNL/TM—10972) Contaminant transport model validation: The Oak Ridge Reservation.** Lee, R.R.; Ketelle, R.H. (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 31p. NTIS, PC A04/MF A01. Order Number DE89001382/JAW.

In the complex geologic setting on the Oak Ridge Reservation, hydraulic conductivity is anisotropic and flow is strongly influenced by an extensive and largely discontinuous fracture network. Difficulties in describing and modeling the aquifer system prompted a study to obtain aquifer property data to be used in a groundwater flow model validation experiment. Characterization studies included the performance of an extensive suite of aquifer test within a 600-square-meter area to obtain aquifer property values to describe the flow field in detail. Following aquifer test, a groundwater tracer test was performed under ambient conditions to verify the aquifer analysis. Tracer migration data in the near-field were used in model calibration to predict tracer arrival time and concentration in the far-field. Despite the extensive aquifer testing, initial modeling inaccurately predicted tracer migration direction. Initial tracer migration rates were consistent with those predicted by the model; however, changing environmental conditions resulted in an unanticipated decay in tracer movement. Evaluation of the predictive accuracy of groundwater flow and contaminant transport models on the Oak Ridge Reservation depends on defining the resolution required, followed by field testing and model grid definition at compatible scales. The use of tracer tests, both as a characterization method and to verify model results, provides the highest level of resolution of groundwater flow characteristics. 3 refs., 4 figs.

57541 **(PNL—6581-Vol.9) Ground-water monitoring compliance projects for Hanford site facilities: Progress report for January 1 to March 31, 1988: Volume 9: Appendix C.** (Pacific Northwest Lab., Richland, WA (USA)). May 1988. Contract AC06-76RL01830. 195p. NTIS, PC A09/MF A01. Order Number DE89000263/JAW.

The appendix is one of nine volumes, and presents data describing wells completed at the Hanford Site during the first quarter of calendar year 1988 (January through March). The data in this volume of Appendix C cover the following wells: 199-N-58; 199-N-59; 199-N-60; 199-N-61; 199-N-67. The data are presented in the following order: Well Completion Report/Title III Inspection List, As-Built Diagram, Logging Charts, and Drill Logs.

57542 **(PNL—6675-Vol.2) Ground-water monitoring compliance projects for Hanford Site facilities: Progress report for the period April 1 to June 30, 1988: Volume 2, Appendices.** (Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 401p. NTIS, PC A18/MF A01. Order Number DE88017212/JAW.

This is Volume 2 of a two-volume set of documents that describes the progress of 10 Hanford Site ground-water monitoring projects for the period April 1 to June 30, 1988. This volume discusses as-built diagrams, drilling logs, and geophysical logs for wells drilled during this period in the 100-N Area (Appendix A) and near the 216-A-36B Crib (Appendix B). Volume 1 discusses the 10 projects. This work was supported by the US Department of Energy under Contract AC06-76RL01830.

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 56336, 56399, 56400, 56401, 56402, 56403, 56404, 57507, 57509, 57540

57543 **(PB—88-229505/XAB) Surface geophysical techniques for aquifer and wellhead protection area delineation. Technical report (Final).** Violette, P. (Environmental Protection Agency, Washington, DC (USA). Office of Ground-Water Protection). Dec 1987. 63p. (EPA—440/12-87/016). NTIS, PC A04/MF A01.

Surface geophysical techniques developed by the petroleum and minerals industries are applicable to ground-water investigations. This document examines some of these techniques to aid in the delineation of aquifers as part of the delineation of wellhead protection areas. Overviewed are seismic, electrical, electromagnetic induction, VLF resistivity, ground penetrating radar, gravity, and magnetic geophysical techniques, and their applicability to aquifer delineation. The theory and methodology of these are discussed, along with the method costs as of early 1987. Also briefly discussed is the delineation of wellhead protection areas.

57544 **(PB—88-234778/XAB) Assessment of nonpoint-source impacts on Illinois water resources. Summary report.** (Illinois Environmental Protection Agency, Springfield (USA). Div. of Water Pollution Control). Aug 1988. 123p. (IEPA/WPC—88-020). NTIS, PC A06/MF A01.

Section 319 of the 1987 Clean Water Act was created to focus on the importance of controlling nonpoint sources of pollution. As required by Section 319, the report was developed to describe the nature, extent and effects of nonpoint-source pollution on Illinois' surface waters, the cause of such pollution, and programs and methods used for controlling pollution. The Assessment additionally identifies in-place pollutant problem areas, statewide ground-water initiatives and studies, and ongoing efforts to inventory state wetlands resources.

5206 Regulations

REFER ALSO TO CITATION(S) 56721

57545 **(PB—88-228887/XAB) Guidance for applicants for state wellhead protection program assistance funds under the Safe Drinking Water Act. Appendix C. Wellhead Protection Program-applicable regulations.** (Environmental Protection Agency, Washington, DC (USA). Office of Ground-Water Protection). Jun 1987. 138p. (EPA—440/6-87/012). NTIS, PC A07/MF A01.

See also PB—88-111430; Portions of this document are not fully legible.

Appendix C is a companion document to the Guidance for Applicants for State Wellhead Protection Assistance Funds Under the Safe Drinking Water Act to explain EPA regulations applicable to the Wellhead Protection Program (WHP) and the assistance application form needed to request a program grant. These two documents are used to develop approvable assistance applications and to administer properly the funds awarded under the WHP program.

57546 **(PB—88-229059/XAB) Resource document for the ground-water monitoring strategy workshop. Final report.** (Temple, Barker and Sloane, Inc., Lexington, MA (USA)). Mar 1985. 287p. NTIS, PC A13/MF A01.

See also PB—88-111877.

The document provides background material to support a workshop to develop a ground-water monitoring strategy. It provides reference to activities in ground-water monitoring and a guide to selected State and Federal ground-water monitoring programs. It also discusses ground-water monitoring initiatives at EPA; existing ground-water monitoring activities at the Federal and State level; case studies of notable monitoring programs and surveys; ground-water resources in the United States; cost of ground-water monitoring, and technical monitoring issues likely to arise during the workshop.

57547 **(PB—88-229067/XAB) Guidelines for ground-water classification under the EPA (Environmental Protection Agency) Ground-Water Protection Strategy. Draft report (Final).** (Environmental Protection Agency, Washington, DC (USA). Office of Ground-Water Protection). Dec 1986. 381p. (EPA—440/6-86/007). NTIS, PC A17/MF A01.

The two-fold purpose of the Guidelines, pursuant to the August, 1984 Ground-Water Protection Strategy, is (1) to define the classes, key terms, and related concepts of the ground-water classification system introduced in the Strategy, and (2) to present the procedures and information needs for classifying ground water. The Final Draft of the Guidelines was issued for public comment in December 1986.

57548 **(PB—88-230933/XAB) Sole-Source Aquifer background study: cross-program analysis. Technical report.** (Environmental Protection Agency, Washington, DC (USA). Office of Ground-Water Protection). Nov 1987. 59p. (EPA—440/6-87/015). NTIS, PC A04/MF A01.

This report is one of a series of documents that summarizes the institutional/policy characteristics and hydrogeologic features of Sole-Source Aquifers (SSAs) in eight of the ten U.S. Environmental Protection Agency (EPA) Regions. The document presents a summary of the key characteristics of all of petitioned aquifers and analyzes similarities and differences among regional programs, as well as among individual aquifers. Data reviewed and extracted from regional files for each SSA include, in part: petitioner data, hydrologic information, ground-water data, population figures, existing contamination conditions, the role of local/State governments, and alternate supply sources. A map showing the geographical location of the SSAs is included.

57549 **(PB—88-231485/XAB) Model assessment for delineating wellhead protection areas. Technical report (Final).** Van der Heijde, P.; Beljin, M.S. (JACA Corp., Fort Washington, PA (USA)). May 1988. 279p. NTIS, PC A13/MF A01.

This report offers a compilation of ground-water computer flow models potentially applicable to Wellhead Protection Areas (WHPA) delineation. EPA's Office of Ground-Water Protection prepared the document in a continuing effort to provide technical assistance to State and local Wellhead Protection Programs based on requirements of the Safe Drinking Water act (SDWA) as amended in 1986. The criteria used to select and evaluate the applicable analytical and numerical models for WHPA delineation is explained in the document and informative reference material of each of 64 models is listed.

57550 **(PB—88-231493/XAB) State and territorial use of ground-water strategy grant funds (Section 106 Clean Water Act). Technical report (Final).** (Environmental Protection Agency, Washington, DC (USA). Office of Ground-Water Protection). May 1987. 22p. (EPA—440/6-87/008). NTIS, PC A03/MF A01.

This document reports on the activities of States in FY 85 and 86 in developing and implementing State ground-water protection strategies using Clean Water Act Section 106 funds. Every State and all but one territory has participated in the program. Strategies have included emphasis on the need to consolidate State and local agency efforts, and to provide clear policy direction, greater public awareness and education concerning ground-water protection.

57551 **(PB—88-233481/XAB) Report on the use of wetlands for municipal waste-water treatment and disposal.** (Environmental Protection Agency, Washington, DC (USA). Office of Municipal Pollution Control). Oct 1987. 32p. (EPA—430/9-88/005). NTIS, PC A03/MF A01.

The report reviews current knowledge of the use of both natural and constructed wetlands for municipal waste-water treatment and disposal. The extent and circumstances of this practice are reviewed, and summaries of the regulatory issues involved as well as EPA policies are presented.

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social And Economic Studies

REFER ALSO TO CITATION(S) 57591

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 56165, 56716, 56721

57552 **(NUREG—0586) Final generic environmental impact statement on decommissioning of nuclear facilities.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Aug 1988. 507p. NTIS, PC A22/MF A01 - GPO. Order Number TI89001073/JAW.

This final generic environmental impact statement was prepared as part of the requirement for considering changes in regulations on decommissioning of commercial nuclear facilities. Consideration is given to the decommissioning of pressurized water reactors, boiling water reactors, research and test reactors, fuel reprocessing plants (FRPs) (currently, use of FRPs in the commercial sector is not being considered), small mixed oxide fuel fabrication plants, uranium hexafluoride conversion plants, uranium fuel fabrication plants, independent spent fuel storage installations, and non-fuel-cycle facilities for handling byproduct, source and special nuclear materials. Decommissioning has many positive environmental impacts such as the return of possibly valuable land to the public domain and the elimination of potential problems associated with increased numbers of radioactively contaminated facilities with a minimal use of resources. Major adverse impacts are shown to be routine occupational radiation doses and the commitment of nominally small amounts of land to radioactive waste disposal. Other impacts, including public radiation doses, are minor. Mitigation of potential health, safety, and environmental impacts requires more specific and detailed regulatory guidance than is currently available. Recommendations are made as to regulatory decommissioning par-

ticulars including such aspects as decommissioning alternatives, appropriate preliminary planning requirements at the time of commissioning, final planning requirements prior to termination of facility operations, assurance of funding for decommissioning, environmental review requirements. 26 refs., 7 figs., 68 tabs.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

REFER ALSO TO CITATION(S) 57032

5502 Biochemistry

REFER ALSO TO CITATION(S) 56033, 57141, 57510, 57566, 57581, 57592, 57606

57553 **(DOE/PC/91025—T1) An investigation to define the physical/chemical constraints which limit NO/sub x/ emission reduction achievable by reburning.** McCarthy, J.M.; Moller, E.C.; Ho, L.; Cole, J.A.; Kramlich, J.C.; Chen, S.L. (Energy and Environmental Research Corp., Irvine, CA (USA)). Apr 1988. 119p. NTIS, PC A06/MF A01. Order Number DE88017222/JAW.

This report describes the efforts performed on an ongoing program designed to investigate the constraints of the reburning process for advanced NO/sub x/ control. The status and history of reburning technology will be reviewed first. This will be followed by descriptions of the program scope, the experimental approach, the experimental results, and the conclusions. Finally, the future work will be outlined and the raw experimental data and the kinetic mechanisms of returning will be presented as appendices. 33 refs., 39 figs.

57554 **Mechanism of aromatic ring cleavage of a β-biphenylyl ether dimer catalyzed by lignin peroxidase of Phanerochaete chrysosporium.** Miki, K.; Kondo, R.; Renganathan, V.; Mayfield, M.B.; Gold, M.H. (Oregon Graduate Center, Beaverton (USA)). *Biochemistry;* **27**: No. 13, 4787-4794(28 Jun 1988). Contract FG06-86ER13550.

Homogeneous lignin peroxidase (LiP) oxidized 1-(4-methoxyphenyl)-2-)2,6-dimethoxy-4-phenylphenoxy)-1,3-propanediol (I) to yield 1-(4-methoxyphenyl)-1,2,3-propanetriol (II), α-(4-methoxyphenyl)-2-oxo-1,3-dioxolane-4-methanol (III), 5-(4-methoxyphenyl)-2-oxo-1,3-dioxolane-4-methanol (IV), 4-oxo-3-phenyl-2-butenoic acid methyl ester (V), 5-hydroxy-4-phenyl-2(5H)-furanone (VI), 4-oxo-3-phenyl-2-pentenedioic acid dimethyl ester (VII), and 5-carbomethoxy-5-hydroxy-4-phenyl-2(5H)-furanone (VIII). Products II-VIII are all derived from the opening of the B aromatic ring of the substrate. Oxidation of I in H_2 ^{18}O resulted in 87% and 65% incorporation of ^{18}O into the carbonyl oxygen of III and IV, respectively. Oxidation of I under $^{18}O_2$ resulted in the incorporation of two atoms of oxygen into the aldehyde (V). Oxidation of I under either $^{18}O_2$ or $H_2{}^{18}O$ resulted in the incorporation of three atoms of oxygen into the lactol VI. Finally, oxidation of I under either $^{18}O_2$ or $H_2{}^{18}O$ indicated that four atoms of oxygen were incorporated into the lactol VIII. These results are explained by a mechanism involving the one-electron oxidation of the B ring of the substrate to an aryl cation radical by the H_2O_2 oxidized enzyme. In these oxidative pathways, only the formation of the aryl cation radical is enzyme-catalyzed. Subsequent reactions appear to be nonenzymatic, accounting for the variety of ring-opened products formed.

57555 **Characterization of the pyrogallol-phloroglucinol isomerase of Eubacterium oxidoreducens.** Krumholz, L.R.; Bryant, M.P. (Univ. of Illinois, Urbana (USA)). *Journal of Bacteriology;* **170**: No. 6, 2472-2479(Jun 1988). Contract AC02-81ER10874.

Cell extracts of Eubacterium oxidoreducens, in the presence of dimethyl sulfoxide, catalyzed the conversion of pyrogallol to phloroglucinol with methyl sulfide as a product. The isomerization reaction also proceeded when 1,2,3,5-benzenetetrol was present rather than dimethyl sulfoxide. An assay to quantitate this activity was developed. The assay followed the disappearance of 1,2,4-benzenetriol as determined colorimetrically after incubation with sodium molybdate at neutral pH. The products of this reaction were resorcinol and 2,6-dihydroxyquinone. The enzyme(s) catalyzing this reaction was purified fivefold from cells grown on gallate plus H_2. The purification procedure involved treatment with 40% acetone, precipitation with ammonium sulfate, DEAE-cellulose chromatography, concentration by ultrafiltration (molecular weight cutoff, > 100,000), and hydroxylapatite chromatography. This preparation had a specific activity of 14.7 μmol/min per mg of protein and a pH optimum of about 7.3. It was strongly inhibited by p-chloromercuribenzoate. The mechanism of the reaction involved oxidation of the pyrogallol followed by introduction of water. The benzenetetrol intermediate was then reduced and dehydrated to phloroglucinol.

57556 **Entry of bacteriophage T7 DNA into the cell and escape from host restriction.** Moffatt, B.A.; Studier, F.W. (Brookhaven National Lab., Upton, NY (USA)). *Journal of Bacteriology;* **170**: No. 5, 2095-2105(May 1988).

T7 DNA did not become susceptible to degradation by the host restriction enzymes EcoB, EcoK, or EcoP1 until 6 to 7 min after infection (at 30°C). During this period, T7 gene 0.3 protein is made and inactivates EcoB and EcoK, allowing wild-type T7, or even a mutant that has recognition sites flanking gene 0.3, to escape restriction by these enzymes. However, T7 failed to escape restriction by EcoP1 even though 0.3 protein was made, evidently because 0.3 protein is unable to inactivate EcoP1. How T7 DNA can be accessible to transcription but not restriction in the first few minutes of infection is not yet understood, but we favor the idea that the entering DNA is initially segregated in a special place. Entry of T7 DNA into the cell is normally coupled to transcription. Tests of degradation of DNAs having their first restriction sites different distances from the end of the DNA indicated that only the first 1000 or so base pairs (2.5%) of the molecule enter the cell without transcription. An exception was the only mutant tested that lacks base pairs 343 to 393 of T7 DNA; most or all of this DNA entered the cell without being transcribed, apparently because it lacks a sequence that normally arrests entry. This block to DNA entry would normally be relieved by the host RNA polymerase transcribing from an appropriately situated promoter, but the block can also be relieved by T7 RNA polymerase, if supplied by the host cell. T7 mutants that lack all three strong early promoters A1, A2, and A3 could grow by using a secondary promoter.

57557 **Computers in molecular biology: current applications and emerging trends.** DeLisi, C. (Dept. of Energy, Washington, DC (USA)). *Science (Washington, D.C.);* **240**: 47-52(1 Apr 1988).

The rate of generation of molecular sequence data is forcing the use of computers as a central tool in molecular biology. Current use of computers is limited largely to data management and sequence comparisons, but rapid growth in the volume of data is generating pressure for the development of high-speed analytical methods for deciphering the codes connecting nucleotide sequence with protein structure and function.

57558 **Target and method for the production of fission product molybdenum-99.** Vandegrift, G.F.; Vissers, D.R.; Marshall, S.L.; Varma, R. US Patent Application 6-112,158. 26 Oct 1987. 17p. Contract W-31109-ENG-38. NTIS, PC A03/MF A01.

A target for the reduction of fission product Mo-99 is prepared from uranium of low U-235 enrichment by coating a structural support member with a preparatory coating of a substantially oxide-free substrate metal. Uranium metal is electrodeposited from a molten halide electrolytic bath onto a substrate metal. The electrodeposition is performed at a predetermined direct current rate or by using pulsed plating techniques which permit relaxation of accumulated uranium ion concentrations within the melt. Layers of as much as to 600 mg/cm² of uranium can be prepared to provide a sufficient density to produce acceptable concentrations of fission product Mo-99. 2 figs.

57559 Method for rapid base sequencing in DNA and RNA. Jett, J.H.; Keller, R.A.; Martin, J.C.; Moyzis, R.K.; Ratliff, R.L.; Shera, E.B.; Stewart, C.C. US Patent Application 6-105,375. 7 Oct 1987. 18p. Contract W-7405-ENG-36. NTIS, PC A03/MF A01.

A method is provided for the rapid base sequencing of DNA or RNA fragments wherein a single fragment of DNA or RNA is provided with identifiable bases and suspended in a moving flow stream. An exonuclease sequentially cleaves individual bases from the end of the suspended fragment. The moving flow stream maintains the cleaved bases in an orderly train for subsequent detection and identification. In a particular embodiment, individual bases forming the DNA or RNA fragments are individually tagged with a characteristic fluorescent dye. The train of bases is then excited to fluorescence with an output spectrum characteristic of the individual bases. Accordingly, the base sequence of the original DNA or RNA fragment can be reconstructed. 2 figs.

57560 Plasmids containing the gene for DNA polymerase I from Streptococcus pneumoniae. Lacks, S.A.; Martinez, S.; Lopez, P.; Espinosa, M. US Patent Application 6-090,623. 28 Aug 1987. 14p. Contract AC02-76CH00016. NTIS, PC A03/MF A01.

A method is disclosed for cloning the gene which encodes a DNA polymerase-exonuclease of {und Streptococcus} {und pneumoniae}. Plasmid pSM22, the vector containing the pneumococcal polA gene, facilitates the expression of 50-fold greater amounts of the PolI enzyme. 1 fig., 1 tab.

57561 Positron emitter labeled enzyme inhibitors. Fowler, J.S.; MacGregor, R.R.; Wolf, A.P. US Patent Application 6-052,921. 22 May 1987. 21p. Contract AC02-76CH00016. NTIS, PC A03/MF A01.

This invention involved a new strategy for imaging and mapping enzyme activity in the living human and animal body using positron emitter-labeled suicide enzyme inactivators or inhibitors which become covalently bound to the enzyme as a result of enzymatic catalysis. Two such suicide in activators for monoamine oxidase have been labeled with carbon-11 and used to map the enzyme subtypes in the living human and animal body using PET. By using positron emission tomography to image the distribution of radioactivity produced by the body penetrating radiation emitted by carbon-11, a map of functionally active monoamine oxidase activity is obtained. Clorgyline and L-deprenyl are suicide enzyme inhibitors and irreversibly inhibit monoamine oxidase. When these inhibitors are labeled with carbon-11 they provide selective probes for monoamine oxidase localization and reactivity in vivo using positron emission tomography. 2 figs.

5504 Genetics

REFER ALSO TO CITATION(S) 57581

5505 Metabolism

REFER ALSO TO CITATION(S) 56445, 56883

57562 Effects of E-64, a cysteine proteinase inhibitor, on cowpea weevil growth, development, and fecundity. Murdock, L.L.; Shade, R.E.; Pomeroy, M.A. (Purdue Univ., West Lafayette, IN (USA)). *Environmental Entomology;* **17**: No. 3, 467-469(Jun 1988). Contract AC02-80ER10715.

E-64, a specific inhibitor of cysteine proteinases, was incorporated into artificial seeds at low levels (0.01-0.25% by weight). It prolonged developmental time and increased mortality of the larval cowpea weevil, Callosobruchus maculatus (F.), in direct proportion to its concentration in the artificial seeds. The fecundity of females emerging from the artificial seeds was significantly decreased by E-64 concentrations of 0.06% and higher. These observations are compatible with the hypothesis that the midgut cysteine proteinase in C. maculatus is essential for normal growth and development.

5506 Medicine

REFER ALSO TO CITATION(S) 57350, 57589, 57592, 57592, 57620

57563 (BNL—41568) Biological efficacy of a boronated porphyrin as measured in cell culture. Laster, B.H.; Kahl, S.B.; Kalef-Ezra, J.; Popenoe, E.A.; Fairchild, R.G. (Brookhaven National Lab., Upton, NY (USA)). 1987. Contract AC02-76CH00016. 10p. (CONF-8705326—1). NTIS, PC A02/MF A01. Order Number DE88016578/JAW.

From 3. international symposium on neutron capture therapy; Bremen, F.R. Germany (31 May 1987).

Attempts to develop a boronated porphyrin analog have suffered from problems associated with toxicity, solubility and, upon occasion, lability of the boron tag. One compound synthesized by one of us (SBK), designated "SBK-II", has evidently overcome the above problems, providing therapeutic amounts of boron in animal tumor models (20-40 μg B/g tumor) with retention times in the order of weeks. As is well known, biological efficacy will depend upon distribution within (or without) the cell. In the experiments detailed here, biological efficacy has been evaluated in Hamster V-79 cells, irradiated at the thermal neutron beam at the Brookhaven Medical Research Reactor, using irradiation geometries and techniques as described in detail elsewhere. Cell survival curves obtained with 15 and 29 μg ^{10}B per ml from $H_3{}^{10}BO_3$ ("ambient" conditions) were compared to a control (no boron) curve (data not shown). 2 refs., 3 figs., 1 tab.

57564 (CONF-870613—1) Radiolabeled porphyrin versus gallium-67 citrate for the detection of human melanoma in athymic mice. Maric, N.; Chan, S. Ming; Hoffer, P.B.; Duray, P. (Yale Univ., New Haven, CT (USA). School of Medicine). 1987. Contract AC02-78EV04625. 18p. NTIS, PC A03/MF A01. Order Number DE88017251/JAW.

From 34. annual meeting of the Society of Nuclear Medicine; Toronto, Canada (2 Jun 1987).

We performed the biodistribution and imaging studies of ^{111}In and ^{67}Ga labeled tetra(4-N-methylpyridyl) porphine, (T4NMPYP), and compared it to that of ^{67}Ga citrate in athymic mice bearing a human melanoma xenograft. The biodistribution results of both ^{111}In and ^{67}Ga labeled T4NMPYP (3, 6, 24, and 48 hours) were similar but differed from that of ^{67}Ga citrate (48 hours). The optimum tumor uptake of both radiolabeled porphyrins was at 6 hours postinjection and was lower than the tumor uptake of ^{67}Ga citrate at 48 hours postinjection. Kidney was the only organ showing higher uptake of radiolabeled porphyrin compared to that of ^{67}Ga citrate. The imaging studies performed with ^{111}In T4NMPYP and ^{67}Ga citrate correspond to the biodistribution results. Osteomyelitis present in one mouse showed good localization of ^{111}In T4NMPYP. 15 refs., 3 figs., 5 tabs.

57565 (INIS-mf—11822) Nuclear medical diagnostic with ventricular aneurysm. A critical sifting of the literature and experiences of the Department for General Nuclear Medicine. Litter, H. (Frankfurt Univ. (Germany, F.R.). Fachbereich Humanmedizin). 10 Feb 1987. 177p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88755171/JAW.

In the diagnostic of ventricular aneurysms myocardial scintigraphy and above all radionuclide ventriculography (RNV) have special importance. Because of the non-invasive method and the as a result safe and easy use even with stress studies, RNV can provide a very valuable aid with aneurysm patients in early diagnosis, evaluation of the operability and as well as in the prognosis. It must be noted, however, that the differentiation of multivascular diseases and sometimes ventricular aneurysms can be difficult and the inclusion of an angiocardiograph as a radiological invasive examination procedure seems fitting.

5507 Microbiology

REFER ALSO TO CITATION(S) 56013, 56023, 56033, 56883, 56885, 57493, 57497, 57531, 57609

57566 **(CONF-8810181—1) The nature of viruses.** Otten, J.A. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 21p. NTIS, PC A03/MF A01. Order Number DE89000429/JAW.

From Assessing bioaerosols in indoor environments; Ann Arbor, MI, USA (4 Oct 1988).

This document provides a basic review of virology, its clinical aspects, and of methods for sampling aerosols containing viruses. 12 refs., 2 tabs. (TEM)

57567 **(CU/KC—8702) Critical review of inorganic sulphur microbiology with particular reference to Alberta soils.** Laishley, E.J.; Bryant, R. (Calgary Univ., Alberta (Canada). Kananaskis Centre for Environmental Research). Feb 1987. 57p. (MICROLOG—88-00574). Acid Deposition Research Program, 150 Sixth Ave. SW, Suite 3800, Calgary, Alta., Canada T2P 3Y7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In this review, the physiology and biochemistry of the microorganisms participating in the sulfur cycle are discussed. Of particular importance to the Alberta situation are the S-oxidizing bacteria, with special reference to the thiobacilli. New species native to Alberta have been isolated and characterized, and their biological properties compared to other known species. Biological oxidation of inorganic S can have economic and ecological repercussions, e.g. creation of acid soils. Factors affecting the oxidation of windblown S include the sulfur itself, whose microstructure and particle size affect the biological oxidation rate; sulfur oxidizing microorganisms, which can oxidize at different rates, the most prolific belonging to the genus Thiobacillus; and the soil environment, in which microbial oxidation is markedly affected by temperature, moisture, and soil type. Windblown sulfur from existing stockpiles or prilling operations will create an ideal soil environment for thiobacilli, resulting in soil acidification. Long term studies of SO/sub 2/ contamination of soils from a nearby gas plant did not show acidification trends. Liming an acid soil polluted with S only masks an existing problem; it actually provides a more favorable environment for continued microbial sulfur oxidation and acidification. To prevent thiobacilli from oxidizing fugitive S, it is recommended to reduce the soil sulfur content, develop a new liming procedure, and stop the fugitive S at the source. A number of recommendations are made for future research. 150 refs., 7 figs., 5 tabs.

57568 **(DOE/PC/80012—T9) Biological production of fuels from coal-derived gases: Final report.** (Arkansas Univ., Fayetteville (USA). Dept. of Chemical Engineering). Apr 1988. Contract AC22-85PC80012. 119p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE88012127/JAW.

As an alternative to catalytic liquefaction, coal-derived synthesis gas may be biologically converted to useful chemicals and liquid fuels by the action of microorganisms. Theoretically, many chemicals may be produced biologically, including methanol, ethanol, acetone, acetic acid (or acetate), and higher acids. Organisms have been identified that are capable of converting carbon monoxide to methanol. However, the organisms to produce other chemicals are largely unknown, so that natural sources of bacteria must be screened for their ability to convert synthesis gas or acetate to liquid fuels and chemicals. A culture has been isolated from animal waste which is capable of producing ethanol and acetate from the carbon monoxide, carbon dioxide, and hydrogen components of synthesis gas. The culture has been able to produce 4.3 g/l of ethanol in small batch culture, but also produces at least 3.2 g/l of acetate (or acetic acid). Media constituents such as east extract and 2-bromoethane sulfonic acid affect the ratio of ethanol to acetate, and agitation promotes mass transfer of carbon monoxide into the liquid phase, thereby enhancing reaction rate. The feasibility of utilizing a biological process to produce liquid fuels from the components of synthesis gas has been demonstrated by operating the culture under continuous feed conditions. Hydrogen and carbon dioxide utilization occurred only when a significant quantity of the carbon monoxide had disappeared. Future work during subsequent contracts should concentrate on producing a single liquid fuel as a product, increasing the product concentration, and defining and optimizing reaction conditions for maximizing product yield. 90 refs., 36 figs., 19 tabs.

5509 Pathology

REFER ALSO TO CITATION(S) 56724, 56725, 56726, 56762, 57460, 57623

57569 **(PB—88-231204/XAB) Cancer risk-specific dose estimate for 2,3,7,8-TCDD. Draft report.** (Environmental Protection Agency, Washington, DC (USA). Office of Health and Environmental Assessment). Jun 1988. 72p. NTIS, PC A04/MF A01.

See also report dated Mar 1988, PB—88-231196.

This draft report focuses on the hazard identification and dose-response assessment for the potential human carcinogenicity of the chemical. The objective of the report is to determine if EPA's 1985 cancer risk assessment for polychlorinated dibenzo-p-dioxins should be modified in light of recent data, alternative risk-assessment methods, or alternative interpretations of data on the chemical. The report concludes that (1) the 1985 assessment that associates a 0.006 pk/kg/day dose with a plausible upper-bound increased cancer risk of one in a million should be reconsidered, and (2) a change to a 0.1 pg/kg/day dose as a plausible upper bound associated with an increased lifetime risk of one in a million is consistent with the available data and theories, and represents a reasonable science policy for the Agency. Also, appendices A through F to the document contain important background information on a broad range of issues related to 2,3,7,8-TCDD including quantitative implications (A), epidemiology (B and D), reproductive and developmental toxicity (C), immunotoxicity (E), and mechanisms of action (F).

57570 **(PB—88-231212/XAB) Cancer risk-specific dose estimate for 2,3,7,8-TCDD: appendices A through F. Draft report.** (Environmental Protection Agency, Washington, DC (USA). Office of Health and Environmental Assessment). Jun 1988. 270p. NTIS, PC A12/MF A01.

See also report dated Jun 1988, PB—88-231204.

This draft report reexamines the scientific basis and methods used by the U.S. Environmental Protection Agency (EPA) for estimating the cancer potency of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). It focuses on the hazard identification and dose-response assessment for the potential human carcinogenicity of this chemical. The objective of the report is to determine if EPA's 1985 cancer risk assessment for polychlorinated dibenzo-p-dioxins should be modified in light of recent data, alternative risk assessment methods, or alternative interpretations of data on the chemical. The report concludes that (1) the 1985 assessment that associates a 0.006 pk/kg/day dose with a plausible upper-bound increased cancer risk of one in a million should be reconsidered, and (2) a change to a 0.1 pg/kg/day dose as a plausible upper bound associated with an increased lifetime risk of one in a million is consistent with the available data and theories, and represents a reasonable science policy for the Agency. Appendices A through F to the document contain important background information on a broad range of issues related to 2,3,7,8-TCDD including quantitative implications (A), epidemiology (B and D), reproductive and developmental toxicity (C), immunotoxicity (E), and mechanisms of action (F).

5510 Physiological Systems

57571 **(DOE/NV/10327—T3) A contribution of groundwater to Mojave Desert shrub transpiration.** Hunter, R.B. (California Univ., Mercury, NV (USA). Lab. for Biomedical and Environmental Sciences). 1988. Contract AC08-84NV10327. 8p. NTIS, PC A02/MF A01. Order Number DE88017320/JAW.

Soil moisture was measured to 1-m depths in the northern Mojave Desert on two plots, one of which was denuded of shrubs. The pattern of wetting-drying near the surface and below the depth wet by rainfall suggested roughly 2 mm per month of transpired

water was supplied by percolation upward from below the root zone. This deep moisture built up during fall and winter and depleted in spring and summer, which correlates well with local shrub phenology. 10 refs., 3 figs.

5520 Public Health

REFER ALSO TO CITATION(S) 56684, 56724, 56725, 56726, 56762

57572 **(AD-A—194835/5/XAB) Evaluation of the potential health hazards associated with the machining of carbon-fiber composites. Final report.** Zustra, M.A. (North Carolina Univ., Chapel Hill (USA)). 1987. 79p. NTIS, PC A05/MF A01.

Industrial-hygiene surveys were conducted to assess personnel exposures to carbon fibers and carbon/epoxy composite dust during carbon-composite airframe sanding operations. The operation is currently performed every two to three weeks for eight hours at a time. The nature and frequency of operation performance is expected to change as more composite aircraft are put into service. The health implications of carbon-composite particulate exposure are not well understood. Good industrial-hygiene practices, however, suggest that exposure levels be kept to a minimum. Recommendations for reducing personnel exposure have been made. To characterize the composite debris, a particle-size distribution and fiber-dimension analyses were done. Additionally, several organizational standards relating to carbon-composite particulates were evaluated. A recommendation for reducing the applicable Coast Guard standards was made. Other potential hazards identified were exposure to solvents during lay-up procedures, and to primer dust during sanding work. Both require further evaluation to determine the extent of the exposure.

57573 **(AD-A—195319/9/XAB) Initial software and data-load procedures for the Navy Occupational Health Information Management Systems (NOHIMS). Final report.** Pearsall, D.M.; Hall, T.M. (Naval Health Research Center, San Diego, CA (USA)). 2 May 1988. 95p. (NHRC—88-16). NTIS, PC A05/MF A01.

This document provides step-by-step instructions for installing the Naval Occupational Health Information Management System (NOHIMS) software. It also describes how to create site baseline systems, daily operations and control, communications, and other system software. The following are key objectives of the Navy Occupational Health Information Management System (NOHIMS): 1) Creation of a safer and healthier work environment for Navy employees by providing timely notification of exposure results, rapid retrieval of hazardous-material data, and ensuring proper medical monitoring; 2) Elimination of time-consuming manual recordkeeping methods; 3) Standardization of recordkeeping procedures; 4) Integration of Environmental surveillance and Medical monitoring components of the Navy's Occupational Health Program; and 5) Establishment of a Navy-wide data base for epidemiological studies. The purpose of the Initial Software and Data Load Procedures (ISDLP) is to provide a detailed guide for the NOHIMS implementation team and the system manager. This document will attempt to provide information not covered elsewhere, and will provide additional material in areas that are especially complex.

57574 **(INIS-mf—11304) Effect of gamma radiation on microorganisms in waste water from hospital.** Piadang, S.; Sermkiattipong, Ng.; Pongpal, S. (International Atomic Energy Agency, Vienna (Austria)). 1988. 5p. (In Thai). (CONF-8802109—).

From 26. annual conference on science and agro-industry; Bangkok, Thailand (3 Feb 1988).

The effect of gamma radiation to the total count and indicative bacteria in waste water from hospitals were studied. It showed that radiation can effectively reduce the quantity of microflora. Total count and MPN of coliform, faecal coliform and E coli was proportionally reversed to the dose applied. Radiation at 2.8 kGy could reduce the total count of waste water from 1.91x10/sup 6/-4.21x10/sup 6/ cells per ml. of waste water to 33.6-3.83x10/sup 2/ cells per ml. of waste water or 4 log cycle. MPN of coliform and faecal coliform bacteria were reduced from 7.31x10/sup 6/-1.57x10/sup 7/ and 2.33x10/sup 6/->1.30x10/sup 7/ per 100 ml. of waste water respectively to 1.4-4.75 and 0-1.5 per 100 ml. of waste water respectively. And E. coli was absent.

57575 **(PB—88-231220/XAB) Techniques for assessing industrial hazards: a manual.** (International Bank for Reconstruction and Development, Washington, DC (USA)). 1988. 171p. (WORLD-BANK-TP—55). NTIS MF A01.

Library of Congress catalog card no. 86-11135; Microfiche copies only. Paper copy available from World Bank, 1818 H St. NW., Washington, DC. 20433.

This manual provides guidelines for the identification of the potential hazards of new or existing plants or processes in the chemical and energy industries, and for the assessment of the consequences of the release of toxic, flammable, or explosive materials to the atmosphere. It presents a structured, simplified approach for identifying the most-serious potential hazards and for calculating their effect distances or damage ranges. It is the intention that by presenting a simplified approach, the manual should be amenable to use by engineers and scientists with little or no experience of hazard analysis. Further analysis with a view to mitigation of the hazards identified may be appropriate in many cases; at this stage, it may be necessary to seek the advice of a specialist. The basic procedure in a hazard analysis is: identify potential failures, calculate release quantities for each failure, and calculate the impact of each release on people and property. For large plants this can become highly complex, and therefore a simplified method is presented, in which the analysis has been divided into 14 steps. A spreadsheet technique was devised to permit the analyses to be carried out on a programmable calculator or personal computer. After the introductory material, the manual outlines the 14 steps that make up the hazard analysis.

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 56720, 57574

57576 **(IAEA-R—3418-F) Performance of the tsetse fly Glossina pallidipes reared under simple laboratory conditions. Final report for the period November 1983 - October 1987.** Otieno, L.H. (The International Centre of Insect Physiology and Ecology, Nairobi (Kenya)). (International Atomic Energy Agency, Vienna (Austria)). Aug 1988. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704333/JAW.

A simple grass-thatched hut was used to rear Glossina pallidipes Austen. Constructed to allow free flow of air, the temperature and humidity inside correspond to that of the outside environment. Pupae used to start the colony were obtained from pregnant females from Lambwe Valley, Western Kenya. Nine day-old females were paired with 12 day-old males for 7 days after which they were separated. Colony performance was evaluated on the basis of female survival, number of puparia produced, and mortality rates. The emergence rate of puparia weighing more than 30 mg was above 80%. Data on the performance of the colony between June 1985 and June 1986 are presented. We suggest that the simple nature of the rearing facility and its direct contact with the outside environment have facilitated the colonization of the flies.

57577 **(IAEA-R—4523-F) In-vitro mutation breeding technology in maize. Final report for the period January 1987 - January 1988.** Nesticky, M. (Maize Research Inst., Trnava (Czechoslovakia)). (International Atomic Energy Agency, Vienna (Austria)). Aug 1988. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704335/JAW.

Gamma-irradiation and in-vitro culture, separately or combined, as a tool for inducing mutation in maize were evaluated. This type of research has been hampered in maize because (i) maize is a cross pollinating crop and highly heterozygous and (ii) embryogenesis and plant regeneration of plants from in-vitro culture have been difficult. In the present study, carefully designed and elaborated experiments were conducted using an inbred line CH1 31 which is capable of somatic embryogenesis for the subject of mutagenesis and another line Bu 8Ro/sub 2/ for the test cross partner. Results showed: 1) Both the regeneration of plants from in-vitro culture

and gamma-irradiation induced a similar spectrum of morphological variation. Although the variation with somaclones was more frequent that radiation induced mutations under the conditions used, combination of explant irradiation and in-vitro culture gave the highest frequencies of genetic variation. 2) Some of the mutations in quantitative characters can be recogned in heterozygous state. 3) Mutation can cause variation in combining ability (extent of heterosis). 4) Efficiency at embryogenesis differs with genotypes of maize. 3 refs, 11 figs, 4 tabs.

57578 **(INIS-mf—11146) Basic studies on the efficacy of gamma irradiation as insect disinfestation and sterilising techniques for stored rice insects.** Abdul Rahim Muda. (Malaysian Agricultural Research and Development Inst., Serdang, Selangor). [1987]. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703579/JAW.

Basic laboratory evaluations on the efficacy of gamma irradiation on the insect sitophilus zeamais, Motch. showed this method of insect control is effective to disinfest both internal and surface infestations in stored milled rice, and substantially reduced reproductive potentials of the weevil. Adult emergence of treated larvae developing within the rice kernel reduced by an average of 82% for treatment doses of 0.05 to 1 kGy. All emerged adults died within 16 days upon emergence at all tested doses. Radiated adult insects showed 100% mortality within 18 days at doses above 0.15 kGy; 26 days at 0.1 kGy and 33 days at 0.05 kGy. However none of the tested doses recorded total immediate mortality after treatment. Significant sterility effects through 93% reduction in F/sub 1/ progenies can be achieved by sterilising both parents; but none of the tested doses showed potential for employment as male sterilising technique alone.

57579 **(INIS-mf—11211) Comparative study of radioimmunoassay dates.** Venegas Sanchez, Ruth. (Universidad Autonoma de Guadalajara (Mexico). Escuela de Biologia). 1986. 143p. (In Spanish). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88703580/JAW.

The radioimmunoassay is frequently used in clinical chemistry for the concentration determination of several substances like hormones as thyrotropine and thyroxine. In this experiment the dates of tyroxine radioimmunoassay are processed by three methods: a) like the recommendation of the IAEA, b) Dr. G. Chase method, c) according to the provider. The best method was Dr. Chase's.

57580 **(INIS-mf—11303) Radiosensitivity of Vibrio parahaemolyticus in seafood.** Piadang, S.; Kraisorn, K. (International Atomic Energy Agency, Vienna (Austria)). 1988. 5p. (In Thai). (CONF-8802109—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704268/JAW.

From 26. annual conference on science and agro-industry; Bangkok, Thailand (3 Feb 1988).

The influence of two salt concentration 0.85% and 3% NaCl, on the radiosensitivity of 3 cultures of Vibrio parahaemolyticus K/sub 3/, K/sub 13/, and K/sub 28/, incoulated into sterile crab meat and pealed shrimp homogerntes was investigated. In peeled shrimp, with 0.85% NaCl, its D/sub 10/ values for strains K/sub 3/, K/sub 13/ and K/sub 28/ were 57.1+-0.50, 62.6+-0.79, 47.9+-0.43 Gy, respectively. The variation of the strains was increased in 3% salt concentration with D/sub 10/ values of 80.5+-0.88, 73.3+-1.04, 52.8+-0.44 Gy, for strains K/sub 3/, K/sub 13/ and K/sub 28/, respectively. For the crab meat honagenate with 0.85% NaCl, its D/sub 10/ value for strains K/sub 3/ and K/sub 13/ were 57.8+-0.72 and 52.1+-0.96 Gy, and the values for 3% NaCl were 70.0+-0.12 and 52.7+-0.82 Gy, respectively. In most cases the complete destruction was obtained with 50-60 kGy. Vibrio parahaemolyticus in seafood could be readily controlled by radicidation.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 57563

57581 **(BNL—41704) Generalized DNA mismatch repair: Its molecular basis in Streptococcus pneumoniae and other organisms.** Lacks, S.A. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 26p. (BIO—4470; CONF-8808128—2). NTIS, PC A03/MF A01. Order Number DE88017336/JAW.

From 9. European meeting on genetic transformation; Canterbury, UK (22 Aug 1988).

Several instances of specialized mismatch repair systems have come to light. In these cases only a single base mispair is recognized, and it is always one particular base in the mispair that is corrected. Thus, mechanisms for correcting G/T or G/A to G/C in specific sequences of E. coli (Lieb, 1987) or S. pneumoniae, respectively, have been observed. Also, E. coli can correct A/G to A/T by a specialized system depending on mutT. These specialized systems will not be further considered here. Rather, the generalized Hex system of S. pneumoniae will be reviewed and compared to generalized repair systems in other species, in particular the Mut system of E. coli. Emphasis will be placed on the mechanisms of targeting the strand for correction and on the effects of UV-irradiation damage on strand targeting. Components of the generalized systems from different species will be compared at the molecular level, and a scheme for the possible evolution of these repair systems will be proposed. 47 refs., 3 figs., 4 tabs.

57582 **(BNL—41705) The {ital polA} gene of {ital Streptococcus pneumoniae} and the enzyme it encodes: Cloning, expression, function and evolution.** Lopez, P.; Martinez, S.; Diaz, A.; Espinosa, M.; Lacks, S.A. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 15p. (CONF-8808128—1; BIO—4471). NTIS, PC A03/MF A01. Order Number DE88017334/JAW.

From 9. European meeting on genetic transformation; Canterbury, UK (22 Aug 1988).

DNA polymerase I (Pol I) of {ital E. coli} has played an important role in elucidating the mechanisms of DNA replication and repair. Its three enzymatic activities{endash}DNA polymerase, 3'-exonuclease, and 5'-exonuclease{endash}and their roles in DNA replication and repair have been considerably investigated (Kornberg, 1980). We have cloned a gene encoding a similar DNA polymerase in {ital S. pneumoniae}, analyzed the structure and expression of the gene, and purified and characterized the pneumococcal Pol I that it encodes. We have also examined cellular functions of the enzyme in {ital S. pneumoniae} and other bacterial hosts. Inasmuch as the Gram-positive {ital S. pneumoniae} and the Gram-negative {ital E. coli} are distantly related species, it is interesting to compare the structure and function of the Pol I proteins from these two sources. 17 refs., 3 figs., 1 tab.

57583 **(CONF-881054—11) ORNL implementation of new health and safety requirements (DOE Order 5480.11).** Abercrombie, J.S. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01. Order Number DE89001193/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

New mandates in radiological protection outlined in DOE Order 5480. 11, include changes in the methodology for determining total radiation dose, ALARA program accountability, monitoring requirements, and standards for public entrance into controlled areas. The new order places distinct requirements concerning training at all DOE facilities. Radiation protection training requirements are addressed, including the effective communication of operations changes to all employees. This paper details the endeavors underway at ORNL in designing, developing, and delivering the training required by the new mandates. Strategies taken to reach the intended goals are explained. Efforts involve the design and implementa-

tion of the above mentioned radiation protection programs, a job-specific ALARA instructional package, and a Risk-Based Philosophy program matched to operational changes. 4 refs., 5 tabs.

57584 **(CONF-881134—1) Modulation of gene expression by fission-spectrum neutrons.** Woloschak, G.E.; Jones, C.A. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88012000/JAW.

From Conference on biotechnology research directions; Argonne, IL, USA (6 Nov 1988).

Ionizing radiations can produce mutant inductions, neoplastic transformation, or cell death; alternatively, the cells can recover from the radiation insult. The molecular mechanisms involved in these processes are not well understood. These studies were designed to examine alterations in gene expression following low doses of neutron irradiation that might indicate the cellular mechanisms underscoring normal cell recovery or the onset of neoplastic transformation. We examined modulation of specific gene expression in Syrian Hamster Embryonic cells at intervals following exposure to fission-spectrum neutrons (24 cGy) from the JANUS reactor at Argonne. 9 refs.

57585 **(CONF-8503299—) Thyroid cancer: Role of radionuclides in diagnosis, management and treatment.** Shah, D.H.; Noronha, O.P.D. (eds.). (Bhabha Atomic Research Centre, Bombay (India). Radiation Medicine Centre). 1986. 246p. U.S. Sales only; domestic audience. Radiation Medicine Centre, Bhadha Atomic Research Centre, C/o Tata Memorial Hospital Annexe Parel, Bombay-400 012, India. Order Number TI89001828/JAW.

From National seminar on thyroid cancer: role of radionuclides in diagnosis, management and treatment; Bombay, India (4 Mar 1985).

The seminar was attended by forty-one distinguished clinicians and scientists from India who are actively associated with thyroid cancer diagnosis, treatment and research. The twenty-seven papers presented at the seminar relate to the relative frequency of thyroid cancer with respect to geographical factors, age, sex type of goitre, the utility and role of various diagnostic techniques like radionuclide imaging, ultrasonography, thermography, the place of biochemical and immunological tumor markers, histological classification of thyroid tumors and on the treatment of thyroid cancer with regard to type of surgery, place of radioiodine therapy, external radiotherapy, and adjuvant chemotherapy. Individual reports are processed separately for the data base.

57586 **(CONF-8806237—1) Experimental animal data and modeling of late somatic effects.** Fry, R.J.M. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 24p. NTIS, PC A03/MF A01. Order Number DE88016811/JAW.

From DOE/CEC workshop; Oak Ridge, TN, USA (22 Jun 1988).

This section is restricted to radiation-induced life shortening and cancer and mainly to studies with external radiation. The emphasis will be on the experimental data that are available and the experimental systems that could provide the type of data with which to either formulate or test models. Genetic effects which are of concern are not discussed in this section. Experimental animal radiation studies fall into those that establish general principles and those that demonstrate mechanisms. General principles include the influence of dose, radiation quality, dose rate, fractionation, protraction and such biological factors as age and gender. The influence of these factors are considered as general principles because they are independent, at least qualitatively, of the species studied. For example, if an increase in the LET of the radiation causes an increased effectiveness in cancer induction in a mouse a comparable increase in effectiveness can be expected in humans. Thus, models, whether empirical or mechanistic, formulated from experimental animal data should be generally applicable.

57587 **(CONF-8809137—1) The new radiation dosimetry for the A-bombs in Hiroshima and Nagasaki.** Kerr, G.D. (Oak Ridge National Lab., TN (USA)). 18 Aug 1988. Contract AC05-84OR21400. 22p. NTIS, PC A03/MF A01. Order Number DE88016801/JAW.

From 14. L. H. Gray conference; Oxford, UK (11 Sep 1988).

Extensive work has been conducted over the past few years to reassess all aspects of the radiation dosimetry for the A-bombs in Hiroshima and Nagasaki. This work has included reviews of the bomb yields, source terms, air transport of neutrons and gamma rays, neutron-induced radioactivity and thermoluminescence in exposed materials, shielding of individuals by buildings, and calculations of organ doses. The results of these theoretical and experimental activities have led to the development of a new dosimetry system which is designated as the Dosimetry System 1986 (DS86). New DS86 estimates of tissue kerma in air and absorbed dose to fifteen organs are available for 94,787 survivors who were either outside and unshielded, outside and shielded by houses, or inside and shielded by houses (64,408 in Hiroshima and 30,379 in Nagasaki). The organ doses are calculated on an age-dependent basis as follows: infants (less than 3 years old at the time of bombing, ATB), children (3 to 12 years old ATB), and adults (more than 12 years old ATB). Work in progress includes the extension of the DS86 system to Nagasaki survivors who were shielded either by terrain or by factory buildings.

57588 (INIS-mf—11311, pp 16) **Dose rate calculations due to external irradiation from radioactively contaminated building iron.** Pokorny, V.; Stubna, M. (Nuclear Power Plants Research Institute, Trnava (Czechoslovakia)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57589 **(INIS-mf—11807) Efficacy of diagnostic radiation uses in pediatrics using the example of skull survey radiographs after skull brain traumas.** Mueller, H. (Freie Univ. Berlin (Germany, F.R.)). 23 Apr 1987. 84p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755168/JAW.

This work is a retrospective efficacy study, where efficiency is left out of consideration. The goal of this work is to examine the efficacy of the radiodiagnostic of skull brain traumas in children and under consideration of the literature already present on this theme to find eventually possibilities for the limitation of the routine radiology or respectively to increase the predictive value by means of the making of a list containing highly effective criteria.

57590 **(INIS-XN—124) Biological basis for the control of prenatal irradiation.** (Nuclear Energy Agency, 75 - Paris (France)). 1988. 47p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704356/JAW.

The embryo and fetus have been generally considered to be more sensitive than the adult to the detrimental effects of radiation exposure. In particular, recent re-evaluations of epidemiological data on human population exposed to radiation have suggested that there may be greater sensitivity than heretofore recognized to the induction of mental retardation and reduced intelligence by exposure during gestation. To assist national authorities in evaluating this problem and establishing appropriate protection measures for limiting the dose to the embryo and fetus and, thus, to pregnant or potentially pregnant women, the Nuclear Energy Agency has appointed a Group of Consultants to assemble and evaluate the biological data relevant to the protection of the human conceptus, and to make recommendations for achieving this in the operational practice. The Group has surveyed the human data dealing with the biologcal effects of radiation exposure at low doses, and has supplemented this with information derived from animal studies. The Group has also taken full account of the studies and recommendations issued in this area by other international organizations, primarily the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and the International Commission on Radiological Protection (ICRP). This report is published under the responsibility of the Secretary General of the OECD, and does not commit Member governments of the Organization.

57591 **(NUREG/CR—4811) The economic costs of radiation-induced health effects: Estimation and simulation.** Nieves, L.A.; Tawil, J.J. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation; Pacific Northwest Lab., Richland, WA (USA)). Aug 1988. Contract AC06-76RL01830. 198p. (PNL—6097). NTIS, PC A09/MF A01 - GPO. Order Number TI89000226/JAW.

This effort improves the quantitative information available for use in evaluating actions that alter health risks due to population exposure to ionizing radiation. To project the potential future costs of changes in health effects risks, Pacific Northwest Laboratory (PNL) constructed a probabilistic computer model, Health Effects Costs Model (HECOM), which utilizes the health effect incidence estimates from accident consequences models to calculate the discounted sum of the economic costs associated with population exposure to ionizing radiation. Application of HECOM to value-impact and environmental impact analyses should greatly increase the quality of the information available for regulatory decision making. Three major types of health effects present risks for any population sustaining a significant radiation exposure: acute radiation injuries (and fatalities), latent cancers, and impairments due to genetic effects. The literature pertaining to both incidence and treatment of these health effects was reviewed by PNL and provided the basis for developing economic cost estimates. The economic costs of health effects estimated by HECOM represent both the value of resources consumed in diagnosing, treating, and caring for the patient and the value of goods not produced because of illness or premature death due to the health effect. Additional costs to society, such as pain and suffering, are not included in the PNL economic cost measures since they do not divert resources from other uses, are difficult to quantify, and do not have a value observable in the marketplace. 83 refs., 3 figs., 19 tabs.

57592 **(ORNL—6499) Biology Division progress report for the period of October 1, 1986--September 30, 1988.** (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 148p. NTIS, PC A07/MF A01. Order Number DE89001140/JAW.

The Biology Division of the Oak Ridge National Laboratory is one component of the Department of Energy's intramural program in life sciences. Accordingly, {approximately}75% of the Division's total budget is derived from the Department of Energy through its Office of Health and Environmental Research. With respect to experimental biology, the congressionally mandated mission of this Office is to study adverse health effects of energy production and utilization. Within this stated broad mission, common themes among the research programs of the Biology Division are interactions of animals, cells, and molecules with their respective environments. Investigations focus on genetic and somatic effects of radiation and chemicals. Goals include identification and quantification of these effects, elucidation of pathways by which the effects are expressed, assessment of risks associated with radiation and chemical exposures, and establishment of strategies for extrapolation of risk data from animals to humans. Concurrent basic studies in genetics, biochemistry, molecular biology, and cell biology illuminate normal life processes as prerequisites to comprehending mutagenic and carcinogenic effects of environmental agents.

57593 **(PB—88-233952/XAB) Factors to be considered in a dosimetry model for risk assessment of inhaled particles.** Martonen, T.; Hofmann, W. (Salzburg Univ. (Austria)). 1986. 10p. NTIS, PC A02/MF A01.

Pub. in Radiation Protection Dosimetry, Vol. 15, No. 4, 225-232(1986).

Clinical findings suggest that bronchogenic tumors have a predilection for certain airway locations in man. Aerosol-deposition studies with laryngeal-tracheobronchial casts and models indicate that such sites in situ correspond to hot spots of deposition, and that cells located at carinal ridges may be particularly susceptible to development of bronchial carcinomas. For cigarette smokers, the etiology of lung cancer may be affected by synergistic interactions following exposures to naturally occurring indoor radon progeny. The problem is exacerbated for workers in the uranium mining and milling industry due to additional exposures to radioactive dust particles. ThIS paper suggests that heterogeneous local-deposition patterns in bronchial airways, concomitant with increased radiation exposure to targeted cells, may be the relevant factor in lung-cancer induction, and implies that enhanced activity sites should be accounted for in risk-assessment carcinogenesis models.

57594 **(PNL—6348) A manual for applying the allowable residual contamination level method for decommissioning facilities on the Hanford Site.** Napier, B.A.; Piepel, G.F.; Kennedy, W.E. Jr.; Schreckhise, R.G. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1988. Contract AC06-76RL01830. 161p. NTIS, PC A08/MF A01. Order Number DE88017122/JAW.

This report describes the modifications that have been made to enhance the original Allowable Residual Contamination Level (ARCL) method to make it more applicable to site-specific analyses. This version considers the mixture of radionuclides present at the time of site characterization, the elapsed time after decommissioning when exposure to people could occur, and includes a calculation of the upper confidence limit of the potential dose based on sampling statistics that are developed during the site characterization efforts. The upper confidence limit of potential exposure can now be used for comparison against applicable radiation dose limits (i.e., 25 mrem/yr at Hanford). The level of confidence can be selected by the user. A wide range of exposure scenarios were evaluated; the rationale used to select the most limiting scenarios is explained. The radiation dose factors used for the inhalation and ingestion pathways were also updated to correspond with the radiation dosimetry methods utilized in the International Commission of Radiological Protection Publications 26 and 30 (ICRP 1977; 1979a,b, 1980, 1981, 1982a,b). This simplifies the calculations, since "effective whole body" doses are now calculated, and also brings the dosimetry methods used in the ARCL method in conformance with the rationale used by DOE in developing the 25 mrem/yr limit at Hanford. 46 refs., 21 figs., 15 tabs.

57595 **(PNL—6584-Vol.3) GENII [Generation II]: The Hanford Environmental Radiation Dosimetry Software System: Volume 3, Code maintenance manual: Hanford Environmental Dosimetry Upgrade Project.** Napier, B.A.; Peloquin, R.A.; Strenge, D.L.; Ramsdell, J.V. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 1223p. NTIS, PC A99/MF A01. Order Number DE89000482/JAW.

The Hanford Environmental Dosimetry Upgrade Project was undertaken to incorporate the internal dosimetry models recommended by the International Commission on Radiological Protection (ICRP) in updated versions of the environmental pathway analysis models used at Hanford. The resulting second generation of Hanford environmental dosimetry computer codes is compiled in the Hanford Environmental Dosimetry System (Generation II, or GENII). This coupled system of computer codes is intended for analysis of environmental contamination resulting from acute or chronic releases to, or initial contamination of, air, water, or soil, on through the calculation of radiation doses to individuals or populations. GENII is described in three volumes of documentation. This volume is a Code Maintenance Manual for the serious user, including code logic diagrams, global dictionary, worksheets to assist with hand calculations, and listings of the code and its associated data libraries. The first volume describes the theoretical considerations of the system. The second volume is a Users' Manual, providing code structure, users' instructions, required system configurations, and QA-related topics. 7 figs., 5 tabs.

57596 **(PNL—6695) Methods to improve routine bioassay monitoring for freshly separated, poorly transported plutonium.** Bihl, D.E.; Lynch, T.P.; Carbaugh, E.H.; Sula, M.J. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 58p. NTIS, PC A04/MF A01. Order Number DE89000684/JAW.

Several human cases involving inhalation of plutonium oxide at Hanford have shown clearance half-times from the lung that are much longer than the 500-day half-time recommended for class Y plutonium in Publication 30 of the International Commission on Radiological Protection(ICRP). The more tenaciously retained material is referred to as super class Y plutonium. The ability to detect

super class Y plutonium by current routine bioassay measurements is shown to be poor. Pacific Northwest Laboratory staff involved in the Hanford Internal Dosimetry Program investigated four methods to se if improvements in routine monitoring of workers for fresh super class Y plutonium are feasible. The methods were lung counting, urine sampling, fecal sampling, and use of diethylenetriaminepentaacetate (DTPA) to enhance urinary excretion. Use of DTPA was determined to be not feasible. Routine fecal sampling was found to be feasible but not recommended. Recommendations were made to improve the detection level for routine annual urinalysis and routine annual lung counting. 12 refs., 9 figs., 7 tabs.

57597 **(PNL-SA—15781) Progress in lung modeling by the ICRP task group.** James, A.C.; Birchall, A. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 34p. (CONF-880514—5). NTIS, PC A03/MF A01. Order Number DE88015934/JAW.

From Workshop on biological assessment of occupational exposure to actinides; Versailles, France (30 May 1988).

The Task Group has reviewed the data on: (a) morphology and physiology of the human respiratory tract; (b) inspirability of aerosols and their deposition in anatomical regions as functions of respiratory parameters; (c) clearance of particles within and from the respiratory tract; (d) absorption of different materials in the blood in humans and in animals. Evidence for evaluating the relative sensitivities of different tissues within the respiratory tract, and for defining cells at risk, has also been reviewed. On these grounds, the Task Group proposes a new model which predicts the deposition, retention and systemic uptake of materials, enabling doses absorbed by different respiratory tissues and other body organs to be evaluated. In the proposed model, clearance is described in terms of competition between the processes moving particles to the oropharynx or to lymph nodes and that of absorption into the blood. From studies with human subjects, characteristic rates and pathways are defined to represent mechanical clearance of particles from each region, which do not depend on the material. Conversely, the absorption rate is determined solely by the material: it is assumed to be the same in all parts of the respiratory tract and in other animal species. For several of the radiologically important forms of actinides, adsorption rates can be derived from animal experiments, or, in some cases, directly from human data. Otherwise, default values are used, based on the current D, W, and Y classification system. 22 refs., 14 figs., 1 tab.

57598 **(UCRL—98687) Personnel neutron dosimetry applications of track-size distributions on electrochemically etched CR-39 foils.** Hankins, D.E.; Homann, S.G.; Westermark, J. (Lawrence Livermore National Lab., CA (USA)). 1 Sep 1988. Contract W-7405-ENG-48. 9p. (CONF-881032—2). NTIS, PC A02/MF A01. Order Number DE89001288/JAW.

From 2. conference on radiation protection and dosimetry; Orlando, FL, USA (31 Oct 1988).

The track-size distribution on electrochemically etched CR-39 foils can be used to obtain some limited information on the incident neutron spectra. Track-size distributions on CR-39 foils can also be used to determine if the tracks were caused by neutrons or if they are merely background tracks (which have a significantly different track-size distribution). Identifying and discarding the high-background foils reduces the number of foils that must be etched. This also lowers the detection limit of the dosimetry system. We have developed an image analyzer program that can more efficiently determine the track density and track-size distribution, as well as read the laser-cut identification numbers on each foil. This new image analyzer makes the routine application of track-size distributions on CR-39 foils feasible. 2 refs., 3 figs.

57599 (UJV—8034-CH,B, pp 17-23) **Pharmacokinetics of /sup 99m/Tc chelates with N-(phenylcarbamoylmethyl) iminodiacetic acid derivatives.** Angelis, B. Sep 1987. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704162/JAW. (CONF-8612161—).

From 4. international symposium of CMEA countries on radiopharmaceuticals and RIA kits; Obninsk, USSR (16 Dec 1986).

Injection solutions were prepared containing /sup 99m/Tc-pertechnetate, chelating agents and stannous chloride. The solutions were injected to rats and the distribution was studied of activity in the blood, liver, bowels, kidneys, and urine in variation with the / sup 99m/Tc chelate used. The results are summed up in tables and are compared with data from the literature. The effect is discussed of the structure of chelating agents on the biodistribution of /sup 99/mTc chelates. (E.S.). 4 tabs., 9 refs.

57600 **Life shortening in mice exposed to fission neutrons and gamma rays. VII. Effects of 60 once-weekly exposures.** Thomson, J.F.; Grahn, D. (Argonne National Lab., IL (USA)). *Radiation Research;* **115**: No. 2, 347-360(Aug 1988).

A total of 6316 B6CF1 mice were exposed to 60 equal once-weekly doses of 0.85-MeV fission neutrons (0.033 to 0.67 cGy per weekly fraction) or ^{60}Co gamma rays (1.67 to 10 cGy per weekly fraction) and were observed until they died. The mean aftersurvival times showed that the dose-response curves for both neutron and gamma-ray exposures were indistinguishable from linear over all doses except the highest neutron dose. The relative biological effectiveness (RBE) for neutrons, calculated as the ratio of the initial slopes of the dose-response curves, was about 20 for both males and females. Essentially the same value was obtained by a number of other analyses of the data. Virtually all of the radiation-specific excess mortality could be attributed to tumors; after decrementation of the population for nontumor deaths, the value of the RBE was not significantly changed.

57601 **Authors reply.** Wilkinson, G.S.; Voelz, G.L.; Wiggs, L.D.; Galke, W.A.; Tietjen, G.L.; Acquavella, J.F. (Los Alamos National Lab., NM (USA)). *American Journal of Epidemiology;* **127**: No. 6, 1323-1324(May 1988).

The authors reply to a letter by Johnson, C.J. which was critical of their report of mortality of plutonium workers at the Rocky Flats Plant. The letter clarifies the method by which the cohort was defined in their study, defends their use of urine bioassays for the assessment of plutonium body burden, and suggests that the report makes a significant contribution to the literature on the potential plutonium has to induce human disease. They state that the results of their studies suggest that increased risk for several cancers cannot be ruled out for persons with plutonium body burdens of 2 nanocuries or more. Their previous recommendation that studies of workers should be continued in future years was reemphasized.

5603 Chemicals Metabolism And Toxicology

REFER ALSO TO CITATION(S) 56814, 57459, 57460, 57461, 57462, 57463, 57494, 57495, 57520, 57567, 57593

57602 **(ADRP—8604) Alberta Government/Industry Acid Deposition Research Program, April 1, 1986 to March 31, 1987.** (Acid Deposition Research Program, Calgary, Alberta (Canada)). Apr 1986. 22p. (MICROLOG—88-00613). Acid Deposition Research Program, 150 Sixth Ave. SW, Suite 3800, Calgary, Alta., Canada T2P 3Y7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Program was formed in 1983 by the Province of Alberta, the Canadian Petroleum Association, Alberta's electric utilities and the Energy Resources Conservation Board. Its objectives are: to provide a comprehensive understanding of the effects and consequences of acid-forming gases on the environment; to provide a scientific basis for sound, long term environmental management and regulatory control with respect to acid-forming gases; to disseminate such information among members, to the public and to government bodies; to undertake any research deemed appropriate; and to encourage and include opportunities for public representation. This report describes the year's activities of the Program. Special attention is paid to efforts in biophysical research, including assessment of the impact of acid-forming gases on Alberta's environment; a human health/medical diagnostic review, investigating the health status of Alberta communities near a sour gas plant; human health research, investigating occupational exposure of gas and thermal plant workers in Alberta; and activities in communications and public involvement. A financial statement is included.

57603 (ALCRC—RRTAC87-3, pp 168-178) **Salt effects on vegetation.** Edwards, I.K. 1987. Alberta Environment, Standard Life Centre, 14th Floor, 10405 Jasper Ave., Edmonton, Alta., CAN T5J 3N4; $N/C; MFCANMET/TID, Energy, Mines and Res. CAN, 555 Booth St.,Ottawa, Ont., CAN K1A 0G1; $10 CAN. (CONF-8504337—; MICROLOG—88-04306).

From Gel and saline drilling wastes in Alberta workshop; Edmonton, Canada (23 Apr 1985).

The effects of salinity on vegetation are manifested primarily as osmotic effects indicated by water stress and secondarily as specific ion effects expressed by nutrient imbalance. The cations, calcium, magnesium, sodium and potassium may replace each other on the soil exchange complex but calcium and magnesium are most important in this regard. Sodium is objectionable because of its harmful effect on soil. Among the anions, chloride is least desirable because of its ease of accumulation and lethal effects although critical concentration varies among plant species. A tentative categorization of trees, shrubs, grasses and forage on the basis of salt tolerance is given. Salt composition is as important a factor as salt concentration in the management of saline drilling wastes. 14 refs.

57604 (ALCRC—RRTAC87-3, pp 18-23) **Toxicity testing and laboratory procedures for analysing and evaluating drilling fluids.** Shaw, D.R. (Energy Resources Conservation Board, Calgary, Alta.). 1987. Alberta Environment, Standard Life Centre, 14th Floor, 10405 Jasper Ave., Edmonton, Alta., CAN T5J 3N4; $N/C; MFCANMET/TID, Energy, Mines and Res. CAN 555 Booth St., Ottawa, Ont., CAN K1A 0G1; $10 CAN. (CONF-8504337—; MICROLOG—88-04306).

From Gel and saline drilling wastes in Alberta workshop; Edmonton, Canada (23 Apr 1985).

The development of laboratory procedures for the testing of drilling fluid toxicity using experiments on fish in Alberta is described. Tests were carried out to investigate the concentration of a particular component necessary to kill haif the test organisms by a 96 hour time limit. When using distilled water, it was found that although a Na or K ion concentration over 20 or 15 ppm, respectively, was lethal when only the Na or K salt was present, when such salts were found in combination with Ca or Mg salts, higher Na or K ion concentrations were tolerable. If the combined Na and K concentration did not exceed 1700 ppM, survival of the fish could be expected if a reasonably high concentration of Ca, Mg, or both were present. This led to the development of a testing program for saline fluids that would make it possible to know whether a saline and toxic sump was toxic due to the salinity or to the organic content. To take into account the fact that fish do not live in distilled water, tests were also conducted using water mineralized to simulate a typical trout stream water found in Alberta. Results from toxicity testing were found to be similar to tests using demineralized water. The test results were used to aid in setting standards and disposal procedures for drilling sump fluids. The paper ends with a discussion of the problem of KCl drilling fluid systems, which tend to produce wastes of higher toxicity and difficulty of disposal. It is recommended that such fluids not be used.

57605 (BNL—41672) **Toxicology of tetramethyltin and other organometals used in photovoltaic cell manufacture.** Hamilton, L.D.; Medeiros, W.H.; Moskowitz, P.D.; Rybicka, K. (Brookhaven National Lab., Upton, NY (USA)). Jan 1988. Contract AC02-76CH00016. 14p. (CONF-880112—3). NTIS, PC A03/MF A01. Order Number DE89001274/JAW.

From Photovoltaics safety conference; Denver, CO, USA (19 Jan 1988).

In photovoltaic cell fabrication, organometals (alkyl metals) may be used in such processes as metalorganic chemical vapor deposition, transparent contact oxide deposition, doping, and ion implantation. Although these compounds offer potential performance advantages over earth metals and possibly greater safety in handling than metal hydrides, they are not without risk to health and property. Most organometals can ignite spontaneously in air. Some also react violently with water. Oxidation by-products from these reactions are hazardous to health. Of the organometals used in photovoltaic cell fabrication, only the toxicology of organotins (triethyl-, trimethyl- and tetramethyltin) was studied extensively. In mammalian systems, tetramethyltin is rapidly dealkylated to trimethyltin. Although tin was classified by some investigators as an essential trace element, the effects of organotin compounds on humans are poorly known. Animal studies show that the most prominent effects of trimethyltin are on the central nervous system. Several observations of poisoning were reported; effects ranged from reversible neurologic disorders to death. Limited available data suggest that humans respond to single acute doses, and more alarmingly, to repeated sub-toxic doses, suggesting a cumulative effect. Toxicologic properties of diethyltelluride also were evaluated in animal experiments. The compound had toxic effects on the blood, liver, kidney, heart, and skin. Based on these studies and others of related compounds (e.g., methylmercury, tributyltin) extreme caution should be exercised in using organometal compounds in photovoltaic cell manufacturing. 54 refs., 3 tabs.

57606 (CONF-8608141—3) **Seedling response to CO_2 enrichment under stressed and non-stressed conditions.** Doyle, T.W. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01. Order Number DE89000425/JAW.

From Industrial symposium on ecological aspects of tree ring analysis; Tarrytown, NY, USA (17 Aug 1986).

Loblolly pine and sweetgum seedlings were obtained from a Duke University phytotron study, where three groups were grown in different atmospheres of CO_2 (i.e., 350, 500, 650 ppmv). Seedlings were grown over three growing seasons, and included a set of water-stressed and non-stressed individuals. X-ray densitometry was used to evaluate growth and density characteristics of the wood samples. Cross-sectional discs of these samples were radiographed and scanned with a microdensitometer to determine ring width, area, density and mass for each growth year. Results indicated significant differences in wood production (ring width, area and mass) between the lowest treatment of CO_2 (350 ppmv) and the higher concentration (500 and 650 ppmv) treatments. While only a few density parameters demonstrated significant changes with increasing CO_2, almost all showed a systematic increase in density with increasing CO_2 concentration. Ring area and mass displayed the greatest degree of change between treatments. Induced drought effects appeared only to strengthen the CO_2-growth association. These findings suggest that naturally stressed trees are also likely to exhibit some growth effect with increasing atmospheric CO_2. And because the greatest margin of response existed between 350 and 500 ppmv, this study emphasizes the importance and need to determine growth responses at preindustrial era CO_2 concentrations in order to more accurately identify the postulated "fertilizer" effect on modern forests. 10 refs., 4 tabs.

57607 (CONF-8808121—1) **Multimedia partitioning of dioxin.** Travis, C.C.; Hattemer-Frey, H.A. (Oak Ridge National Lab., TN (USA)). [1988]. Contract AC05-84OR21400. 13p. NTIS, PC A03/MF A01. Order Number DE88016788/JAW.

From Workshop on intermedia pollutant transport: modeling and field measurements; Santa Monica, CA, USA (23 Aug 1988).

The general population is continuously being exposed to trace amounts of dioxin as exemplified by the fact that virtually all human adipose tissue samples contain dioxin levels of three parts per trillion (ppT) or greater. The purpose of this study is to investigate how 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) is partitioned in the environment and to identify the major pathways of human exposure. 61 refs., 6 tabs.

57608 (CONF-8809155—1) **Detection and quantitation of benzo[a]pyrene-DNA adducts in brain and liver tissues of Beluga whales (Delphinapterus leucas) from the St. Lawrence and Mackenzie Estuaries.** Shugart, L.R. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01. Order Number DE89000645/JAW.

From International forum on the future of the Beluga; Tadoussac, Canada (29 Sep 1988).

It should be noted that there are few analytical techniques available for the detection and quantitation of chemical adducts in the DNA of living organisms. The reasons for this are: the analytical technique often has to accommodate the unique chemical and/

or physical properties of the individual chemical or its metabolite; the percentage of total chemical that becomes most of the parent compound is usually detoxified and excreted; not all adducts that form between the genotoxic agent and DNA are stable or are involved in the development of subsequent deleterious events in the organism; and the amount of DNA available for analysis is often quite limited. 16 refs., 1 tab.

57609 **(CU/KC—8702) Effects of acid-forming emissions on soil microorganisms and microbially-mediated processes.** Visser, S.; Danielson, R.M.; Parr, J.F. (Calgary Univ., Alberta (Canada). Kananaskis Centre for Environmental Research). Feb 1987. 86p. (MICROLOG—88-00572). Acid Deposition Research Program, 150 Sixth Ave. SW, Suite 3800, Calgary, Alta., Canada T2P 3Y7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Microorganisms are directly and indirectly responsible for the welfare of the higher plants. Increases in H ion concentration as a result of acid deposition can affect the soil microflora directly by affecting cell membrane permeability and enzyme systems at the cell surface. Cell surface exposure to anionic solubility products of sulfur dioxide can also have direct toxic effects. Indirect effects of acid deposition include nutrient deficiencies, solubilization of Al and Fe to toxic levels, modification of plant physiological conditions, and modification of the nutrient quality of plant residues available to the decomposer microflora. At this point, it is difficult to determine if soil acidification caused by deposition of acid forming emissions from anthropogenic sources has similar effects as natural soil acidification. A review of field and laboratory studies has revealed that acidic inputs (primarily as simulated acid rain) can have widely varying effects on the various components of the soil microbial community. According to these studies, the soil pH levels at which significant alterations appear to occur are: nitrogen fixation, pH 6; ectomycorrhizae, not clear; vesicular-arbuscular mycorrhizae, pH 6; organic matter decomposition, pH 2-4; ammonification, pH 3; microbial community structure, pH 3-4; soil enzymes, not clear. It should be kept in mind that most studies dealing with acid deposition effects on soil respiration, carbon mineralization, microbial community structure, and decomposition/nutrient cycling processes have been conducted on naturally acidic forest soils where an already acid-adapted microflora exists. 141 refs., 12 tabs.

57610 **(CWSO—CW69-1/62E) Studies of the effects of acidification on aquatic wildlife in Canada: waterfowl and trophic relationships in small lakes in northern Ontario.** McNicol, D.K.; Bendell, B.E.; Ross, R.K. (Canadian Wildlife Service, Ottawa, Ontario). 1987. 155p. (In English and French). (MICROLOG—88-00405). Canadian Wildlife Service, 175 Woodward Dr., Ottawa, Ont., Canada K1A 0E7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In this study, the distribution, density and habitat preferences of waterfowl were examined throughout much of northeastern and central Ontario using aerial survey counts of indicated nesting pairs. The number of waterfowl breeding in acid-sensitive areas was estimated at 105,000 pairs; breeding densities were relatively low, and no significant trends in population levels have been noted since 1980. In 1983, trophic relationships were studied on lakes at various stages of acidification. Data on water quality, fish and macroinvertebrate community composition and waterfowl productivity were collected from an acid-sensitive area which receives moderate inputs of atmospheric pollutants, and a heavily acid-stressed area. Lake environments were categorized into 4 major components of variation: axes of acidity, ionic strength, eutrophication, and lake morphometry. Bedrock lithology explained much of the variability observed on the acidity and ionic strength axes and was a function of the balance between mineral acid inputs and acid-neutralizing capacity. The availability of food for many waterfowl species has been influenced by lake acidification in the lakes studied in northeastern Ontario. An increased occurrence of fishless lakes in the acid-stressed area correlated with lake acidity. Piscivorous waterfowl studied had indications of lower reproductivity in the acid-stressed area. In the absence of fish, large insects were abundant; insectivorous waterfowl preferred fishless lakes as a probable consequence of reduced competition with fish for insect prey. Omnivorous waterfowl showed no preference for acidic or fishless lakes. 207 refs., 35 figs., 30 tabs.

57611 **(LP/RB—79-37E) Acid rain.** Curren, T. (Canada Library of Parliament, Ottawa, Ontario. Research Branch). Apr 1987. 47p. (MICROLOG—88-00811). Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, Ont., Canada K1A 0S9; $N/C; MF CANMET/TID, Energy, Mines and Resources CAN, 555 Booth St., Ottawa, Ont., CAN K1A 0G1; $10 CAN.

Acid rain has become a subject of major concern to many Canadians. This paper presents an outline of the acid rain issue from the Canadian perspective. Acid rain formation is briefly described, and the most important pollutants for acifiying rain are identified as sulfur dioxide and nitrogen oxides. Sources of these pollutants in North America are identified as being mainly from the transportation and electric power generation sectors. Considerations affecting the acid-forming potential of these pollutants are also discussed, and the increase in emissions from tall stacks is mentioned as a factor in deposition patterns and loadings. Environmental effects of acid rain are summarized in the light of current knowledge. These include mortality effects on fish, damage to plants, effects on the human respiratory system, and corrosion of man-made structures. Areas of Canada most affected by acid rain are identified as those having low acid-buffering capacity, primarily in Ontario, Quebec and Labrador. Canadian parliamentary action on the acid rain problem has consisted in establishing a Subcommittee on Acid Rain in the House of Commons Standing Committee on Fisheries and Forestry, and in amending the Clean Air Act to harmonize it with comparable laws in the USA that deal with transboundary air pollution. A chronology is presented of the actions of Canada and the USA toward the transboundary acid rain problem. 11 refs.

57612 **(ORNL/TM—10858) PCB annual report for Oak Ridge National Laboratory, 1987.** Dailey, N.S.; Puett, T.T. (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 35p. NTIS, PC A03/MF A01. Order Number DE89001145/JAW.

Oak Ridge National Laboratory prepares a report annually as mandated by the Toxic Substances Control Act that summarizes records required of owners/operators of facilities where PCBs are in use. This report provides information on PCB and PCB-contaminated equipment in use or removed from service and PCB wastes generated, stored, and shipped off-site for treatment and disposal during calendar year 1987. 3 refs; 11 tabs.

57613 **(PB—88-241054/XAB) Large-scale compartment-fire toxicity study: comparison with small-scale toxicity test results.** Braun, E.; Levin, B.C.; Paabo, M.; Gurman, J.L.; Clark, H.M. (National Bureau of Standards, Washington, DC (USA). Center for Fire Research). Jul 1988. 84p. (NBSIR—88-3764). NTIS, PC A05/MF A01.

Ten large-scale single-compartment fire tests were performed using two polyurethane foams and a cotton upholstery fabric. Animals were exposed to the products of decomposition of cushion assemblies burned under three different combustion modes: smoldering combustion; flaming combustion; and smoldering-to-flaming transition combustion. Comparison of gas yields (CO, CO_2, and HCN) between these tests and prior large- and small-scale tests showed that the CO and CO_2 yields agreed within a factor of 3, while the NBS Toxicity Protocol produced 10 times more HCN in the flaming mode and ramped heating mode than the large-scale tests. Model calculations showed that within-exposure animal deaths in small- and large-scale tests correlated with model values greater than 0.7. Burn room animal deaths could not be explained in terms of the four gases used in the N-gas model.

57614 **(PNL—6672) Inhalation reproductive toxicology studies: Sperm morphology study of n-hexane in B6C3F1 mice: Final report.** Mast, T.J.; Hackett, P.L.; Decker, J.R.; Westerberg, R.B.; Sasser, L.B.; McClanahan, B.J.; Rommereim, R.L.; Evanoff, J.J. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1988. Contract AC06-76RL01830. 145p. NTIS, PC A07. Order Number DE89000262/JAW.

The straight-chain hydrocarbon, n-hexane, is a volatile, ubiquitous solvent routinely used in industrial environments. Although myelinated nerve tissue is the primary target organ of hexane, the testes have also been identified as being sensitive to hexacarbon exposure. The objective of this study was to evaluate the epididymal sperm morphology of male B6D3F1 mice 5 weeks after exposure to 0, 200, 1000, or 5000 ppM n-hexane, 20 h/day for 5 consecutive days. Two concurrent positive control groups of animals were injected intraperitoneally with either 200 or 250 mg/kg ethyl methanesulfonate, a known mutagen, once each day for 5 consecutive days. The mice were weighed just prior to the first day of exposure and at weekly intervals until sacrifice. During the fifth post-exposure week the animals were killed and examined for gross lesions of the reproductive tract and suspensions of the epididymal sperm were prepared for morphological evaluations. The appearance and behavior of the mice were unremarkable throughout the experiment and there were no deaths. No evidence of lesions in any organ was noted at sacrifice. Mean body weights of male mice exposed to n-hexane were not significantly different from those for the 0-ppM animals at any time during the study. Analyses of the sperm morphology data obtained 5 weeks post-exposure (the only time point examined) indicated that exposure of male mice to relatively high concentrations of n-hexane vapor for 5 days produced no significant effects on the morphology of sperm relative to that of the 0-ppM control group. 24 refs., 2 figs., 7 tabs.

57615 **(PNL—6679) Inhalation reproductive toxicology studies: Male dominant lethal study of n-hexane in Swiss (CD-1) mice: Final report.** Mast, T.J.; Rommereim, R.L.; Evanoff, J.J.; Sasser, L.B.; Decker, J.R.; Stoney, K.H.; Weigel, R.J.; Westerberg, R.B. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1988. Contract AC06-76RL01830. 193p. NTIS, PC A09. Order Number DE89000271/JAW.

The straight-chain hydrocarbon, n-hexane, is a volatile, ubiquitous solvent routinely used in industrial environments; consequently, the opportunity for industrial, environmental or accidental exposure to hexane vapors is significant. Although myelinated nerve tissue is the primary target organ of hexane, the testes have also been identified as being sensitive to hexacarbon exposure. The objective of this study was to evaluate male dominant lethal effects in Swiss (CD-1) mice after exposure to 0, 200, 1000, or 5000 ppM n-hexane, 20 h/day for 5 consecutive days. Each exposure concentration consisted of 30 randomly selected, proven male breeders; 4 groups. The mice were weighed just prior to the first day of exposure and at weekly intervals until sacrifice. Ten males in each dose group were sacrificed one day after the cessation of exposure, and their testes and epididymides were removed for evaluation of the germinal epithelium. The remaining male mice, 20 per group, were individually housed in hanging wire-mesh breeding cages where they were mated with unexposed, virgin females for eight weekly intervals; new females were provided each week. The mated females were sacrificed 12 days after the last day of cohabitation and their reproductive status and the number and viability of the implants were recorded. The appearance and behavior of the male mice were unremarkable throughout the study period and no evidence of n-hexane toxicity was observed. 18 refs., 3 figs., 11 tabs.

57616 **(PNL-SA—16124) Blood, sweat, tears and success of technology transfer long-term controlled-release of herbicides: Root-growth-inhibiting biobarrier technology.** Van Voris, P.; Cataldo, D.A.; Burton, F.G.; Skeins, W.E. (Pacific Northwest Lab., Richland, WA (USA)). 1988. Contract AC06-76RL01830. 8p. (CONF-880631—52). NTIS, PC A02/MF A01. Order Number DE89000398/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, USA (26 Jun 1988).

Through the unique combination of polymers with a herbicidally active dinitroaniline, a cylinderical pellet (9mm long and 9mm in diameter) was developed that continuously releases a herbicide for a period of up to 100 years. Equilibrium concentration of the herbicide in soil adjacent to the pellet and the bioactive lifetime of the device cam be adjusted by changing the size of the pellet; the type of polymer; the type, quality, and quantity of carrier; and/or the concentration and type of dinitroaniline used. Commercial products that have been developed under a Federal Technology Transfer Program that utilize this technology include: (1) ROOT-SHIELD, a root repelling sewer gasket for concrete, clay, and PVC sewer lines, (2) BIOBARRIER, a spun-bonded polypropylene geotextile fabric developed to prevent root growth from invading septic tanks; penetrating under roadways, and along the edge of sidewalks, airport runways, and tennis courts, and for landscaped areas; and (3) ROOT-GUARD, a plastic drip irrigation emitter designed to protect buried drip irrigation systems from being plugged by roots. 17 refs., 4 figs., 6 tabs.

57617 **(STF—21A87114) Effects of oil spills on vegetation.** Klokk, T. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Dec 1987. 19p. (In Norwegian). (CONF-8702157—1). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754901/JAW.

From Conference on petroleum and environment; Trondheim, Norway (17 Feb 1987).

The report deals with ecological impact studies of oil spills. The various affecting factors from huge accidental oil spills and experimental oil spills on the sea are given for various shore-line areas. The effects on the terrestrial environment such as salt marh communities and various tundra biotopes are presented. 3 drawings, 3 tables. 28 references.

57618 **Determining an acceptable level of risk.** Travis, C.C.; Hattemer-Frey, H.A. *Environmental Science and Technology;* **22**: No. 8, 873-876(Aug 1988).

Past regulatory decisions explicitly acknowledge that some risks (i.e., risks in the range of 10^{-6} to 10^{-3}) are acceptable in modern society. Regulatory agencies have an obligation to limit human exposure to chemical carcinogens to levels that are both acceptable and as low as reasonably achievable. However, the view that all risks greater than 10^{-6} are unacceptable and should be regulated no matter what the cost is economically unrealistic and is not compatible with past regulatory practice. Although it may seem barbaric to argue that some risks are acceptable and therefore must be endured by society, past regulatory decisions indicate that in many circumstances risks greater than 10^{-4} are in fact tolerated.

57619 **Growth and development of the pink bollworm, Pectinophora gossypiella (Lepidoptera: Gelechiidae), on bolls of cotton grown in enriched carbon dioxide atmospheres.** Akey, D.H.; Kimball, B.A.; Mauney, J.R. (Dept. of Agriculture, Phoenix, AZ (USA)). *Environmental Entomology;* **17**: No. 3, 452-455(Jun 1988). Contract AI01-81ER60001.

The pink bollworm, Pectinophora gossypiella (Saunders), was reared on the bolls of cotton plants grown in CO_2-enriched (649 μl/liter) and ambient CO_2 (371 μl/liter) chambers and in two open field plots, one with free-air CO_2 enrichment (522 μl/liter) and one without enrichment (ambient CO_2, 360 μl/liter). The effects of increased CO_2 levels on growth and development were examined. There was no difference in pupal weights of pink bollworm raised on CO_2-enriched cotton compared with those raised on ambient CO_2 cotton (26.80 versus 26.64 mg, respectively). Also, there was no difference in developmental time (21-27 d). Analysis of percent seed damage by larvae showed no differences between CO_2-enriched and ambient CO_2 cotton. These results were attributed to the nutritional qualities of the seed remaining the same (specifically the carbon/nitrogen ratio) despite CO_2 and photosynthetic changes in the plant.

57620 **High pressure liquid chromatographic method for the separation and quantitation of water-soluble radiolabeled benzene metabolites.** Sabourin, P.J.; Bechtold, W.E.; Henderson, R.F. (Lovelace Inhalation Toxicology Research Institute, Albuquerque, NM (USA)). *Analytical Biochemistry;* **170**: No. 2, 316-327(1 May 1988). Contract AC04-76EV01013.

The glucuronide and sulfate conjugates of benzene metabolite as well as muconic acid and pre-phenyl- and phenylmercapturic acids were separated by ion-pairing HPLC. The HPLC method developed was suitable for automated analysis of a large number of tissue or excreta samples. p-Nitrophenyl [^{14}C]glucuronide was used as an internal standard for quantitation of these water-soluble metabolites. Quantitation was verified by spiking liver tissue with various amounts of phenylsulfate or glucuronides of phenol, catechol,

or hydroquinone and analyzing by HPLC. Values determined by HPLC analysis were within 10% of the actual amount with which the liver was spiked. The amount of metabolite present in urine following exposure to [^{3}H]benzene was determined using p-nitrophenyl [^{14}C]glucuronide as an internal standard. Phenylsulfate was the major water-soluble metabolite in the urine of F344 rats exposed to 50 ppm [^{3}H]benzene for 6 h. Muconic acid and an unknown metabolite which decomposed in acidic media to phenylmercapturic acid were also present. Liver, however, contained a different metabolic profile. This indicates that urinary metabolite profiles may not be a true reflection of what is seen in individual tissues.

57621 **Soybeans and acid deposition: analyses of dose-response data from field experiments.** Oden, N.; Moskowitz, P.D.; Medeiros, W.H. (Brookhaven National Lab., Upton, NY (USA)). *Journal of the Air Pollution Control Association;* 38: No. 2, 171-173(Feb 1988). Contract AC02-76CH00016.

Effects of acid deposition on several soybean varieties have been studied in field settings by many investigator and were used in a national-level assessment of the effect of changing acid deposition levels of soybean production across the US. Estimation of the impacts soybean production from current or projected acid deposition levels requires that dose-response data from a few sites and for a few varieties be applied over large geographic, temporal, and biologic space. To the extent that the dose-response relationships are not homogeneous across these variables, imprecisions and inaccuracies are introduced into the assessment process. Systematic error may also be introduced from fitting functionally incorrect dose-response models which produce false effects estimates. In response to these issues, this report updates previous efforts to examine homogeneity of response coefficients from field experiments among different experiments.

5604 Other Environmental Pollutant Effects

57622 **(AD-A—195389/2/XAB) Hush House-induced vibrations at the Arkansas Air National Guard Facility, Fort Smith, Arkansas. Environmental research papers, 1 October 1986-30 September 1987.** Battis, J.C. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 13 Nov 1987. 106p. (AFGL-TR—87-0320). NTIS, PC A06/MF A01.

The T-10 jet engine ground run-up noise suppressor, or Hush House, was designed to reduce the audible effects of jet engine testing on the surrounding community. At least in part, the noise-suppression characteristics of the Hush House are achieved by the transfer of energy from the audible (> 20 Hz) to the infrasonic range (<20 Hz). At some sites these lower-frequency emissions have had deleterious effects on the vibro-acoustic environment of nearby buildings. This report describes a case study on this problem and demonstrates that existing siting criteria for the Hush House are inadequate; in one case being too stringent and in another case too lax. An acoustic-emissions model for the Hush House is proposed based on multiple jet-type sources.

57623 **(PB—88-232434/XAB) Model for estimating the risk for hearing damage due to noise exposure.** Oftedal, G. (Norges Tekniske Hoegskole, Trondheim. Electronics Research Lab.). Mar 1988. 18p. NTIS, PC E03/MF E03.

Also pub. as Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway) rept. no. STF44-A88051.

The risk for hearing damage is estimated for 4 noise exposures. The equivalent level of the exposures is compared with the risk calculated by using an intensity-weighting curve. In certain cases, the two methods for estimating the risk for hearing damage give significantly different results.

57 HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 57163

57624 **(KFA-ASS—0476) Nuclear Research Centre Juelich. 1987 annual work report of the Department for Safety and Radiation Protection.** Hille, R. (ed.). (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Abt. Sicherheit und Strahlenschutz). Mar 1988. 247p. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88755292/JAW.

The Department for Safety and Radiation Protection continues to be responsible for coordinating radiation protection, safety and protection at the KFA. It supports the other institutes and departments in performing the safety tasks allotted to them. The principal tasks of the Department are in administrative and technical assistance to these organization units and in safeguards. Administrative assistance involves, for example, regulation of the radiation protection organization in the institutes, including the appointment of radiation protection officers (Strahlenschutzbeauftragte). Furthermore, this includes the central handling of the registration system with the authorities and dealing with outside firms thus considerably relieving the institutes of their administrative tasks. Handling licensing procedures and the central accountancy of radioactive materials is also to be mentioned in this context. Technical assistance largely consists of developing, maintaining and repairing radiation measuring instruments and in the monitoring of personnel by evaluating personnel dosimeters and incorporation controls for radioactive sources. The safeguards tasks of the Department concern the very staff-intensive physical protection, as well as environmental protection and industrial safety.

58 GEOSCIENCES

57625 **(PB—88-232954/XAB) Strategy for earth science from space in the 1980's and 1990's. Part 2: atmosphere and interactions with the solid earth, oceans, and biota.** (National Academy of Sciences, Washington, DC (USA). Commission on Physical Sciences, Mathematics, and Resources). 1985. 167p. NTIS, PC A08/MF A01.

See also PB—83-144121; Color illustrations reproduced in black and white.

Part II of the report of the Committee on Earth Sciences presents a strategy for the future study of the atmosphere and its interactions with the land, oceans, and biota using satellite observatories. Part I (A Strategy for Earth Science from Space in the 1980's, Part I: Solid Earth and Oceans, National Academy Press, 1982) earlier presented a parallel strategy for the future study of ocean dynamics, solid earth dynamics, and continental geology. Together, Parts I and II provide an overall strategy for the study of the Earth from space over the next 10 to 15 years. The committee identifies scientific problems whose solution involves global measurements achievable most inexpensively by space missions alone or by a combination of space missions and other types of observational systems.

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 56047, 56333, 56334, 57271, 57272, 57535

57626 **(DOE/MC/20422—2599) Geologic characterization of tight gas reservoirs: Annual report, FY 1987.** Law, B.E.; Spencer, C.W.; Keighin, C.W.; Lickus, M.R.; Pollastro, R.M.; Johnson, R.C.; Nuccio, V.F.; Charpentier, R.R.; Wandrey, C.J. (Geological Survey, Denver, CO (USA)). Oct 1987. Contract AI21-83MC20422. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88010261/JAW.

The objectives of US Geological Survey (USGS) work are to conduct geologic research characterizing tight gas-bearing sequences in the western United States. Additional critical objects are to provide geologic consulting and research support for ongoing Multiwell Experiment (MWX) engineering, petrophysical, log-analysis, and well-testing research. The USGS research during the last

few years has been in the Greater Green River, Piceance, and Uinta basins of Wyoming, Colorado, and Utah. However, beginning in FY-87 our efforts have been restricted for the most part to the Greater Green River basin. 16 refs., 20 figs.

57627 **(DPST—88-476) SRP [Savannah River Plant] aquifer characterization study: Program plan.** Bledsoe, H.W.; Kaback, D.S. (Savannah River Lab., Aiken, SC (USA)). 14 Apr 1988. Contract AC09-76SR00001. 10p. NTIS, PC A02/MF A01. Order Number DE89001642/JAW.

Detailed geochemical and physical characterization of the aquifers underlying the Savannah River Plant (SRP) is proposed now that the Baseline Hydrogeologic Investigation has been completed. The baseline program included (1) installation of observation wells, (2) collection of water level data, and (3) detailed lithologic description of the sediments cored during the well installations. The existing data points (existing well clusters and core) can now be used to add to the understanding of the geologic, stratigraphic, and geohydrologic framework of the site. The program plan details a proposed approach to delineate the hydrogeologic systems underlying the SRP site in terms of water resources utilization and limitation, contaminant transport, and recharge/discharge patterns. The total time to accomplish the proposed tasks is estimated at 24 months; estimated cost is approximately $800,000. Funding will be required over at least two fiscal years.

57628 **(GS—M46-412E) The Prairie Creek Embayment and lower Paleozoic strata of the southern Mackenzie Mountains.** Morrow, D.W.; Cook, D.G. (Geological Survey of Canada, Ottawa, Ontario). 1987. 211p. (MICROLOG—88-00466). Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, Ont., Canada K1A 0S9; $17.00 OTHER COUNTRIES $20.40 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Lower Paleozoic strata in the southern Mackenzie Mountains (Yukon) are mainly shallow water carbonates which were deposited on a broad depositional shelf. Dramatic changes in the shelf edge position were due to the inception, growth and disappearance of Root Basin and Prairie Creek Embayment. In Middle Ordovician to Middle Silurian time, subtidal deepwater limestone, shale and dolostone acucmulated in Root Basin, and shallow water dolostones formed on the basin rim. Orange, dolomitic siltstones of the Cadillac Formation, fossiliferous limestone of the Vera Formation and laminated, silty dolostones and evaporites of the Camsell Formation filled Root Basin in the Late Silurian to Early Devonian. By that time, the Basin was no longer depositional and the entire southern Mackenzie Shelf was covered by shallow water, intertidally deposited dolostones. However, the Basin's southern entrance remained as a deep water embayment along the shelf edge, and was dominated by centripetal hemipelagic sedimentation with abundant sediment gravity flow deposits of detrital carbonates, derived in part from the shelf edge. Following deposition of the Arnica Formation dolostones, the Basin region again received deepwater shale and limestone sediments briefly, but, by latest Early Devonian, the complex paleogeography of Root Basin and Prairie Creek Embayment was replaced by a linear depositional shelf edge along which shallow water fossiliferous limestones of the Nahanni and Headless formations were deposited. This study provides a basis for understanding the mineral and hydrocarbon resources of this area of the southern Yukon. 84 refs., 80 figs., 3 tabs.

57629 **(NAGRA-NTB—84-02) NAGRADATA. Code key. Geology.** Mueller, W.H.; Schneider, B.; Staeuble, J. (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland); Schneider DATA PROJECTS (Switzerland); Geologisches Buero Dr. Heinrich Jaeckli AG (Switzerland)). (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Jan 1984. 97p. (In German). Nagra, CH-5401 Baden, Switzerland.

This reference manual provides users of the NAGRADATA system with comprehensive keys to the coding/decoding of geological and technical information to be stored in or retreaved from the databank. Emphasis has been placed on input data coding. When data is retreaved the translation into plain language of stored coded information is done automatically by computer. Three keys each, list the complete set of currently defined codes for the NAGRADATA system, namely codes with appropriate definitions, arranged: 1. according to subject matter (thematically) 2. the codes listed alphabetically and 3. the definitions listed alphabetically. Additional explanation is provided for the proper application of the codes and the logic behind the creation of new codes to be used within the NAGRADATA system. NAGRADATA makes use of codes instead of plain language for data storage; this offers the following advantages: speed of data processing, mainly data retrieval, economies of storage memory requirements, the standardisation of terminology. The nature of this thesaurian type 'key to codes' makes it impossible to either establish a final form or to cover the entire spectrum of requirements. Therefore, this first issue of codes to NAGRADATA must be considered to represent the current state of progress of a living system and future editions will be issued in a loose leave ringbook system which can be updated by an organised (updating) service.

57630 **(NAGRA-NTB—84-03) NAGRADATA. User's handbook. Volume 1.** Mueller, W.H.; Schneider, B.E.; Staeuble, J. (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland); Schneider DATA PROJECTS (Switzerland); Geologisches Buero Dr. Heinrich Jaeckli AG (Switzerland)). (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Sep 1984. 208p. (In German). Nagra, CH-5401 Baden, Switzerland.

NAGRADATA has been created to provide a single, centralised data base so that the large quantities of information collected in the NAGRA field investigation program 'Nordschweiz' may be stored safely and at the same time made accessible to all accredited users. The system makes use of the following components: The computer program System 2000, a data management code commercially available from the INTEL Corporation. This code is used to deal with all aspects of data storage and retrieval and also those of data protection and security. A coding system for the concise description of data relevant to the geological sciences. A system for recording data from geological sciences, which includes data recording forms and an appropriate file structure. An extensive suite of programs to ensure the easy and correct transfer of field and laboratory data to the data base. The principal aims hereby are to relieve the scientific field worker responsible for the data collection and to undertake various plausibility and validation tests of the incoming data. This manual describes the data base file structure. It includes a description of each block of information and also of each item of data. An introductory section containing a summary is provided to each chapter to enable the user to obtain an overview. (author) 11 refs., 71 figs.

57631 **(ORNL/ESH—1/V26) Resource management plan for the Oak Ridge Reservation: Volume 26, Resource Management Organization data base and bibliography.** Lahmon, J.A. (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 131p. NTIS, PC A07/MF A01. Order Number DE88017309/JAW.

A reference collection was developed by the Information Support Unit of the Information Services Division for the Resource Management Organization. Located in Building 4500N, the reference collection contains print copies of documents dealing with environmental aspects of the Oak Ridge Reservation from 1942 to the present. Subjects in this collection include environmental monitoring, hydrology, wildlife management, geology, environmental assessment, and area studies. Information for this collection was retrieved by searching internal and external data bases; conducting personal interviews; and by cross-referencing bibliographies (including those already in the collection), indexes, and Laboratory Records report lists. This is a dynamic collection that will continue to expand to include new and additional documents as they are identified. A data base containing a bibliographic citation and an abstract (when available) for each document in the collection has also been constructed. The data base was established to create bibliographies on specific environmental aspects of the Oak Ridge Reservation. The data base includes search capabilities by several specific fields as well as by free text. For example, the data base can be searched by author, title, descriptor, report number, conference

title, date of publication, document type, or any combination of the above. Additionally, the data base can be searched "free-text" by a single word or phase found in the citation or abstract. For additional information, the Information Support Unit can be reached at (615)574-9150 or (615)574-0819. Any comments or suggestions concerning items for inclusion should also be directed to the Information Support Unit {approximately}1200 items.

57632 **(RFC—8711) Spring runoff summary, 1987.** (River Forecast Centre, Edmonton, Alberta (Canada)). Nov 1987. 40p. (MICROLOG—88-00548). Alberta Environment, Standard Life Centre, 14th Floor, 10405 Jasper Ave., Edmonton, Alta., Canada T5J 3N4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report presents data on spring runoff and snow depth in each of the 15 runoff zones of Alberta. In each zone, a hydrometric station was selected to reflect the spring runoff conditions, and streamflow hydrographs for these stations are included. Maps show spring runoff and precipitation (September to March) by zone, in relation to normal or average values. 20 figs., 15 tabs.

57633 **(WHC-SA—0320) Modeling of hydrologic perturbations during reverse circulation drilling: 2, Model application and results.** Connelly, M.P.; Sagar, B. (Westinghouse Hanford Co., Richland, WA (USA)). May 1988. Contract AC06-87RL10930;AC06-76RL01830. 20p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE89001076/JAW.

A numerical model for coupled flow and mass transport was used to simulate the perturbations caused by the drilling of a deep borehole, its cleanup and installing of piezometers in it. The geologic system was made up of layers of varying hydrogeologic properties. Boundary conditions for the flow and mass transport equations were changing with time as drilling proceeded and was the main cause of the hydrologic perturbation. A conservative tracer was mixed with the drilling fluid (water) to observe the extent of hydrologic penetration by this fluid. Numerical results indicate that once the drilling fluid penetrates the formations, it will require considerable pumping to clean up the borehole completely. 2 refs., 3 figs., 3 tabs.

57634 **Contrasts in thermal maturity within terranes and across terrane boundaries of the Franciscan Complex, northern California.** Underwood, M.B.; O'Leary, J.D.; Strong, R.H. (Univ. of Missouri, Columbia (USA)). *Journal of Geology;* **96**: No. 4, 399-415(Jul 1988).

The Franciscan subduction complex of northern California includes several tectonostratigraphic units. The authors have used the technique of vitrinite reflectance to document levels of thermal maturity for the Central Belt and the Yager, Coastal, and King Range terranes. Spatial variations in thermal maturity help define the thermal structure of each Franciscan terrane, and each terrane displays a different geometry of thermal structure. These differences are controlled by the style of structural deformation, the overprinting effects of deformation following metamorphism, and thermal overprinting caused by hydrothermal circulation. Anomalies along and contrasts across terrane boundaries help establish the relative timing and the structural mechanisms of terrane amalgamation. For example, localized anomalies are evident along the Eel River fault (Central-Yager boundary), and these increases in thermal maturity may be due to shear heating, hydrothermal discharge, or conductive heat transfer across the fault. Cross-cutting relationships also exist between isoreflectance contours and terrane boundaries; these discordant geometries were caused by post-amalgamation hydrothermal overprinting of the King Range terrane and by late-stage fault dislocation along the Yager-Coastal boundary. 67 references.

5802 Geophysics

REFER ALSO TO CITATION(S) 57446, 57626

57635 **(AD-A—194990/8/XAB) Maximum-likelihood multichannel deconvolution of P waves at seismic arrays. Final report, 1 October 1985-1 October 1986.** Der, Z.A.; Lees, A.C.; Chan, W.W.; Shumway, R.H.; McLaughlin, K.L. (Teledyne Geotech, Alexandria, VA (USA). Alexandria Labs.). Nov 1987. 176p. (TGAL—87-3). NTIS, PC A09/MF A01.

The results of maximum-likelihood multichannel deconvolution applied to array recordings and three component station networks for teleseismic P waves, are presented and interpreted in terms of possible surface reflections and other arrivals from explosions conducted at many of the world's major nuclear test sites. The deconvolution method utilizes the well-known fact that P-wave spectra can be decomposed into source and receiver spectral factors. The source functions obtained in the deconvolution process provide a better picture of the nature of explosion source-time functions, and in particular of the presence or lack of secondary arrivals following the P wave such as pP or spall. The presence of such secondary arrivals and their effects on the first cycle of the P wave are very important in yield estimation. Significant variations in the deconvolved source time function between test sites may be associated with topography and testing practices. All of the source functions show complexity in addition to the initial P arrival and pP arrival, if present. There is also a great deal of variation between different source time functions for events at the same test site. Often, but by no means always, events occurring near each other look particularly similar. The site functions are also complex in most cases, and azimuthal variations are significant in both source and receiver regions. Site and source effects contribute about equally to the energy observed in the P codes of the events analyzed. Deconvolved source time functions should be especially useful for improving estimates in the m/sub b/ bias between test sites and to improve yield estimates since site as well at t*, instrument, and any known source spectra are removed.

57636 **(CONF-880583—4) Fracture zone identification in the Appalachian fold and thrust belt determined from geophysical logs.** Dreier, R.B.; Leat, M.B. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 32p. NTIS, PC A03/MF A01. Order Number DE89001209/JAW.

From International conference on fluid flow in fractured rocks; Atlanta, GA, USA (15 May 1988).

The Oak Ridge Reservation (ORR) is located in the Appalachian fold and thrust belt and is comprised of a series of Paleozoic sedimentary rocks that have been structurally duplicated by thrust faulting. All rock units are fractured as a result of the faulting. The fractures are related to medium-scale fault structures (30 to 300 ft[10 to 100 m]) and small-scale (0.5 to 10 in[1 to 20 cm]) deformation of the thrust sheet. Identification and characterization of fracture zones associated with medium-scale faults were accomplished through borehole geophysical techniques. Although the strata on the ORR are pervasively fractured, geophysical log fracture anomalies were primarily associated with medium-scale thrust and tear faults. Estimation of fault displacements suggests that a fracture zone can develop without substantial fault movement. In addition, although a fracture zone can enhance fracture porosity, the associated fault plane may act as a barrier to fluid flow. Investigations showed that a suite of geophysical well logs rather than a single log is essential for fracture zone identification. At the ORR, the borehole televiewer (BHTV), natural gamma ray, and epithermal neutron logs were most useful in fault identification, and the temperature, BHTV, dual induction, and porosity crossplot logs were most useful for fracture zone characterization. 9 refs., 9 figs.

57637 **(CONF-8709347—1) Probing the processes and products of an ancient continental crustal rupture: Scientific drilling into the Midcontinent Rift System.** Hinz, W.J. (Purdue Univ., Lafayette, IN (USA)). 1988. Contract FG02-87ER13784. 20p. NTIS, PC A03/MF A01. Order Number DE88017285/JAW.

From Midcontinent rift system scientific drilling workshop; Duluth, MN, USA (23 Sep 1987).

Geochemical and geophysical investigations over the past decade suggest a laterally as well radially heterogeneous upper mantle. The sources of this variability are mantle dynamics and interactions with the crust. The opportunities to sample these variations directly are limited within continental regions. However, the basalts of the Midcontinent Rift (MCR) System of North America are particularly attractive for studying subcontinental mantle. The MCR is an 1100 Ma paleorift that extends for more than 2000 km across the North American midcontinent. Drill holes into the MCR to obtain samples of the basalt can be located to answer critical questions regarding the origin and evolution of this aborted Precambrian rift. Outcrops of the MCR rocks occur only in the Lake Superior region, and the rocks that crop out are restricted largely to the margins of the structure and the upper part of the stratigraphic section. Available drill holes are shallow and poorly distributed for scientific purposes and provide only limited samples for analysis. Many sites along the rift have been pinpointed where holes of 5 km or less in depth can be drilled to sample the Proterozoic (Keweenawan) igneous rocks of the rift. In September, 1987, approximately 90 geoscientists from North America and Europe met in Duluth, Minnesota, for a workshop. The goals of the workshop were to define the scientific objectives of drilling the MCR and to develop a plan for achieving these objectives. As a result of the workshop and subsequent deliberations, we proposed a multi-year, multi-hole program of drilling and related scientific investigation of the MCR utilizing shallow to intermediate depth holes. 18 refs. 5 figs.

57638 (DPST—88-470-Rev.2) **Savannah River Laboratory's Seismic Program.** Stephenson, D.E.; Steele, J.L. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 26 Apr 1988. Contract AC09-76SR00001. 13p. NTIS, PC A03/MF A01. Order Number DE89001650/JAW.

The decline of prototype developments and seasonal aspect of SRIC harvesting mandate examination of conventional logging machines. These machines can be practical provided sufficient stem size.

57639 (EPRI-NP—5875, pp 2.1-2.17) **Use of Eastern North America ground motion data in evaluating ground motion predictions.** Atkinson, G.M. Aug 1988. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016089/JAW. (CONF-8703282—).

From Earthquake ground-motion estimation in Eastern North America; Palo Alto, CA, USA (31 Mar 1987).

Available ground motion data for eastern North America include seismographic recordings, strong ground motion data, and Modified Mercalli Intensity (MMI) observations from historical earthquakes. The data are insufficient to enable reliable empirical ground motion relations to be developed directly through regression or similar analyses. However, they are extremely useful for evaluating and improving ground motion models that have been developed by other techniques, such as theoretical modeling, or by inference from other regions. Seismographic data are most useful for determining regional geometric and anelastic attenuation properties. Strong motion data are required to validate near-source amplitudes and their scaling with magnitude. MMI data provide a means of checking models for consistency with important historical observations. 16 references.

57640 (EPRI-NP—5875, pp 3.1-3.15) **Review of Eastern Canada intensity and ground motion relations, and data.** Weichert, D. (Pacific Geoscience Center, Sidney, British Columbia (Canada)). Aug 1988. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016089/JAW. (CONF-8703282—).

From Earthquake ground-motion estimation in Eastern North America; Palo Alto, CA, USA (31 Mar 1987).

Over the last few years new data have challenged some of the assumptions that were used for the new Canadian zoning maps. In 1982, the Miramichi earthquake series in New Brunswick yielded observations at the lower magnitude end of the potentially damaging earthquake magnitude range. More important were the Nahanni, NWT, earthquakes of 1985. From the evidence reviewed in this paper, the empirical ground motion relations used in the current Canadian hazard maps are still reasonable if employed as described. However, physically based extrapolations to larger magnitudes will become desirable for areas where no strong motion records are available. Attenuation relations should be revised and, more importantly, more regionalization must be recognized. For the largest events expected on land in eastern Canada, in the Charlevoix seismic zone, it appears reasonable to accept the Nahanni strong motion records as design ground motion. Tectonic considerations suggest that the sources should be similar. Intensity comparison shows similar assymmetries, following the tectonic trends. The extreme accelerations recorded on only one instrument near the December Nahanni earthquake will have to be backed up by additional field investigations to become credible. More information on the near source Nahanni acceleration and attenuation is expected from a more detailed study of the almost 100 strong motion records from a range of different magnitude events that were recovered. 22 references.

57641 (EPRI-NP—5875, pp 4.1-4.30) **Regional crustal frequency dependent Q and site effects estimated from LRSM and RSTN data.** Gupta, I.N.; McLaughlin, K.L. (Teledyne Geotech, Alexandria, VA (USA)). Aug 1988. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016089/JAW. (CONF-8703282—).

From Earthquake ground-motion estimation in Eastern North America; Palo Alto, CA, USA (31 Mar 1987).

Frequency-dependent Q and site terms are derived by analyzing three-component, short-period data from 90 earthquakes and 17 explosions recorded at 53 LRSM and 4 RSTN stations (454 earthquake-station pairs). Multivariate least squares inversion is applied to three different measures of ground motion: PSRV and Velocity response spectra and Lg bandpass filtered amplitudes. Analysis of data for the entire Eastern North America (ENA) indicates Q as well as the vertical component (C/sub z/) and horizontal component (C/sub h/) site terms are significantly frequency dependent. Both C/sub z/ and C/sub h/ tend to be large, differing by as much as a factor of 20. The mean ratio of the peak horizontal to peak vertical component (H/Z) is a stable characteristic of the site, being significantly larger for soft-rock than for hard-rock sites. Theoretical modeling of Lg site terms is attempted for three recording stations with known subsurface structure by assuming the upward propagation of equal amounts of SH and SV waves. The predicted and observed H/Z show remarkably good agreement in both absolute value and frequency dependence. A comparison of the zones of anomalous MM intensity on the isoseismal map of the 1886 Charleston, South Carolina earthquake with the site terms derived in this study shows good correlation. 15 references, 18 figures, 2 tables.

57642 (EPRI-NP—5875, pp 6.1-6.31) **Use of observational data in evaluating theoretical models of ground response.** Chang, C.Y.; Power, M.S. (Geomatrix Consultant, Inc., San Francisco, CA (USA)). Aug 1988. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016089/JAW. (CONF-8703282—).

From Earthquake ground-motion estimation in Eastern North America; Palo Alto, CA, USA (31 Mar 1987).

Downhole seismic arrays provide very useful data for studying local site effects on ground motion and for evaluating theoretical models of ground response. Recordings of earthquake ground motion from downhole arrays indicate that local site effects on ground motion are present at all sites examined, including rock sites. The major trends for site amplifications seen in the recorded data were generally captured by the theoretical wave propagation models. Nevertheless, significant differences, from an engineering prediction viewpoint, were observed in individual spectral peaks and valleys of recorded and predicted motions at some depths and frequencies. Overall, plane wave propagation theory appears to provide a reasonable means of estimating effects of local soil conditions on ground motion, but the analytical procedures must be used with due consideration for the limitations and uncertainties in these types of analyses. 16 references, 18 figures.

57643 (EPRI-NP—5875, pp 7.1-7.10) **Incorporation of site effects in stochastic source models for prediction of earthquake ground motion.** Joyner, W.B. (Geological Survey, Menlo Park, CA (USA)). Aug 1988. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016089/JAW. (CONF-8703282—).

From Earthquake ground-motion estimation in Eastern North America; Palo Alto, CA, USA (31 Mar 1987).

The stochastic omega-square model of Hanks and McGuire (1981) has had remarkable success in predicting a variety of measures of earthquake ground motion over a range in moment magnitude from 0 to 9. This success has encouraged attempts to use the model for predicting ground motion in eastern North America, where too few data are available for empirical prediction methods. Atkinson (1984) used the model with random-vibration-theory methods to obtain predictive equations for peak horizontal acceleration and velocity at rock sites in eastern North America, and Boore and Atkinson (1987) used the model with both time-domain simulation methods and random-vibration theory methods for the prediction of response spectra at rock sites in eastern North America. This paper is concerned with methods for incorporating site effects into ground-motion predictions made with stochastic source models by both time-domain simulation and random-vibration-theory methods. The paper begins with a review of the principal ways in which site effects modify ground motion.

57644 (EPRI-NP—5875, pp 8.1-8.42) **Aftershock sequence for the earthquake of January 31, 1986 in northeastern Ohio: effects of bandwidth and local geology on observed high-frequency ground motion.** Borcherdt, R.D.; Glassmoyer, G. (Geological Survey, Menlo Park, CA (USA)). Aug 1987. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016089/JAW. (CONF-8703282—).

From Earthquake ground-motion estimation in Eastern North America; Palo Alto, CA, USA (31 Mar 1987).

A 10-station array of broad-band digital instrumentation (GEOS) was deployed by the US Geological Survey to record the aftershock sequence of the moderate (m/sub b/ ~ 4.9) earthquake that occurred on January 31, 1986 (16:46:43 UT) near Painesville, Ohio. The sequence consisted of 13 events through April 15, 1986 with local magnitudes in the range of about 0.5-2.5. Focal mechanism solutions for one of the larger aftershocks suggests oblique right slip with 30° rake on a near-vertical nodal plane striking N25°E. This strike is consistent with a slight NE trend in six hypocenter locations located as of February 10, 1986 at depths ranging from 3.4 to 6.1 km. High-resolution recordings (~ 96 dB) of two of the larger aftershocks (m/sub b/ ~ 2.2, 2.5) show seismic signals above background noise levels as high as 130 Hz at epicentral distances of up to 18 km. Levels of ground shaking at frequencies near 20 and 65 Hz were significantly higher at a site at 18 km range underlain by lakeshore sediments than those levels observed at a site closer (~ 8 km) to the epicenter, underlain by more consolidated materials. Exaggerated levels of shaking observed on the containment structure at the nearby Perry Nuclear Plant at frequencies near 20 Hz are most likely dominated by response characteristics of the structure and not by local site effects. Peak acceleration values inferred from the high-resolution aftershock recordings are about factors of two and four times larger than those that would be recorded on conventional instrumentation with upper bandwidth limits of 30 and 15 Hz, respectively. Effects of local site conditions and instrumentation bandwidth on high-frequency ground motions (> 20 Hz) are likely to be of most significance for small to moderate earthquakes occurring in areas of low attenuation such as eastern North America. 25 references, 15 figures, 4 tables.

57645 (EPRI-NP—5875, pp 9.1-9.28) **Theoretical prediction of site specific response.** Finn, W.D.L. Aug 1987. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016089/JAW. (CONF-8703282—).

From Earthquake ground-motion estimation in Eastern North America; Palo Alto, CA, USA (31 Mar 1987).

Current procedures for estimating site-specific ground motions in the free field during earthquakes are evaluated using acceleration data recorded at a number of sites in Mexico City during the September 19, 1985 Mexican earthquake. A procedure for estimating seismic response when there is significant soil-structure interaction is also evaluated using data from simulated earthquake shaking of centrifuged models. 19 references, 25 figures, 1 table.

57646 (EPRI-NP—5875, pp 10.1-10.12) **Applicability of one-dimensional nonlinear site response analysis.** Pyke, R. Aug 1987. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016089/JAW. (CONF-8703282—).

From Earthquake ground-motion estimation in Eastern North America; Palo Alto, CA, USA (31 Mar 1987).

There is a notion, widely held among geotechnical engineers, that the effects of soil deposits on earthquake ground motions can be satisfactorily modeled by analyses in which horizontal motions are treated solely as vertically propagating shear waves. Others, commonly geophysicists and seismologists, have questioned these models, at least for some site conditions, or have questioned the validity of the assumption of vertical wave propagation, or have questioned the need to consider nonlinear soil behavior. That geotechnical engineers, who presumably know more about soil behavior, and geophysicists and seismologists, who without doubt are better at performing linear elastic wave propagation analyses, should interpret the one necessarily incomplete set of data differently should not be a total surprise. Few attempts have been made to reconcile the different points of view and to provide guidelines on when the geotechnical engineer's class of site response analyses is applicable and when it is not. In this paper the writer makes a preliminary attempt at providing such guidelines. The discussion is divided into five parts as follows: (1) the reasons for site effects; (2) the prerequisites for soil deposits to have well-defined effects on earthquake motions; (3) consideration of the degree to which the assumption of vertically propagating body waves and linear elasticity are justified; (4) consideration of the relative importance of site effects and other factors which may affect the ground motions at a specified location; and (5) the applicability of site response analyses in evaluating the potential for earthquake-induced liquefaction of saturated cohensionless soil sites. The term site effects in this paper refers only to the effect of shallow soil or rock layers and is not intended to include the effects of surface topography or deep stratigraphy.

57647 (EPRI-NP—5875, pp 11.1-11.15) **Design and operation of a test-site near Parkfield, California to compare and test methods of estimating the effect of surface geology on seismic motion.** Tucker, B.E.; Real, C.R. (California Dept. of Conservation, Sacramento (USA)). Aug 1987. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016089/JAW. (CONF-8703282—).

From Earthquake ground-motion estimation in Eastern North America; Palo Alto, CA, USA (31 Mar 1987).

A project is underway near Parkfield, California to test and compare the reliability and cost of various methods used to estimate the effects of local soil conditions on earthquake ground motion. A systematic study of this kind is needed before methods can be used routinely to assess an area's potential for strong ground shaking and to incorporate the results into land use, design, and construction decisions on a regular basis. This need is not limited to California, but applied to all of the US and many other areas of the world. The success of this project will require the broad, active support of the seismological, earthquake engineering, and earthquake planning communities throughout the world.

57648 (EPRI-NP—5875, pp 12.1-12.40) **Comparison of source scaling relations of eastern and western North American earthquakes.** Somerville, P.G.; McLaren, J.P.; LeFevre, L.V.; Burger, R.W.; Helmberger, D.V. (Woodward-Clyde Consultants, Pasadena, CA (USA)). Aug 1987. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016089/JAW. (CONF-8703282—).

From Earthquake ground-motion estimation in Eastern North America; Palo Alto, CA, USA (31 Mar 1987).

Source scaling relations have been obtained for earthquakes in eastern North America and other continental interiors, and com-

pared with a relation obtained for earthquakes in western North America. The scaling relation for eastern North American earthquakes was constructed from measurements of seismic moment and source duration obtained by the waveform modeling of seismic body waves. The events used include nine events of m/sub bLg/ magnitude 4.7 to 5.8 that occurred after 1960, and four earlier events with magnitudes between 5.5 and 6.6. The scaling relation for events in other continental interiors was used for comparative purposes and to provide constraints for larger magnitudes. Detailed analysis of the uncertainties in the scaling relations has allowed the resolution of two important issues concerning the source scaling of earthquakes in eastern North America. First, the source characteristics of earthquakes in eastern North America and other continental interiors are consistent with constant stress drop scaling, and are inconsistent with non-constant scaling models such as that of Nuttli (1983b). Second, the stress drops of earthquakes in eastern North America and other continental interiors are not significantly different from those of earthquakes in western North America, and have median values of approximately one hundred bars. The source parameters of earthquakes in eastern North America are consistent with a single constant-stress-drop scaling relation, whereas the source parameters of earthquakes in western North America are much more variable and show significant departures from an average scaling relation in which stress drop decreases slightly with seismic moment. 65 references, 14 figures, 2 tables.

57649 (EPRI-NP—5875, pp 13.1-13.12) **Spectral difference between western and eastern US earthquakes.** Kanamori, H. (California Institute of Technology, Pasadena (USA)). Aug 1987. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016089/JAW. (CONF-8703282—).

From Earthquake ground-motion estimation in Eastern North America; Palo Alto, CA, USA (31 Mar 1987).

The measured stress drop values and spectral amplitudes are subject to large uncertainties because of the sparse data set currently available. However, various measurements indicate that the variation of the stress drop of earthquakes in different tectonic provinces is probably about a factor of 5, on the average. Earthquakes in subduction zones seem to have the lowest stress drops, and events in intraplate regions have the highest. In the standard omega-square model, the above difference in the stress drop corresponds to a factor of 3 difference in the amplitude of high-frequency spectral amplitudes. If the repeat time is an important factor controlling the stress drop, as suggested by some empirical data, the variation of stress drops within the group of earthquakes in the western US could be as large as that between earthquakes of western and eastern US. Thus, the spectral structure of some western US earthquakes with relatively long repeat times may be similar to that of the eastern US earthquakes.

57650 (EPRI-NP—5875, pp 14.1-14.17) **Earthquake source spectra - a comparison between western and eastern US earthquakes.** Papageorgiou, A. (Rensselaer Polytechnic Institute, Troy, NY (USA)). Aug 1987. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016089/JAW. (CONF-8703282—).

From Earthquake ground-motion estimation in Eastern North America; Palo Alto, CA, USA (31 Mar 1987).

The paper examines how the heterogeneity of the fault plane of tectonic earthquakes affects the complexity of the shape of the source spectrum. Data are presented that demonstrate the existence of the so-called patch corner frequency, which is related to the scale-length of heterogeneities of the fault plane. Such a frequency is a distinct feature of the source spectrum of the specific barrier model of Papageoriou and Aki. Furthermore, the paper compares and discusses the spectral features of western and eastern US earthquakes in terms of the heterogeneity characteristics of the lithosphere in the two tectonic regions. 34 references, 4 figures, 1 table.

57651 (EPRI-NP—5875, pp 15.1-15.21) **Prediction of earthquake ground motions in eastern North America using simple models of source spectrum and wave propagation.** Toro, G.R. (Risk Engineering, Inc., Golden, CO (USA)). Aug 1987. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016089/JAW. (CONF-8703282—).

From Earthquake ground-motion estimation in Eastern North America; Palo Alto, CA, USA (31 Mar 1987).

In a recent paper, Toro and McGuire (1986, 1987) presented a method for the prediction of high-frequency ground motion in Eastern North America (ENA) for small and large distances. They used the ground-motion model to calculate a theoretical relationship between m/sub bLg/ and seismic moment (M_0). A continuing problem in the application of this method has been the difference between the theoretical m/sub bLg/ - M_0 relationship and the data compiled by Nuttli (1983). This paper examines the theoretical m/sub bLg/ - M_0 relationship and compares it with data, including m/sub bLg/ values obtained from filtered ECTN recordings, and proposes a new relationship based on Nuttli's (1973) m/sub bLg/ equation. The ground-motion predictions obtained with this new relationship are then calculated and compared with data from strong-motion instruments and from the ECTN and LRSM networks. This paper also examines the effect of different source-scaling assumptions on ground-motion predictions. Finally, model predictions for spectral velocities (1, 5 and 10 Hz) and for peak acceleration are written in the functional form of standard attenuation functions. 26 references, 6 figures, 3 tables.

57652 (EPRI-NP—5875, pp 16.1-16.16) **Notes on the prediction of ground motion and response spectra at hard-rock sites in eastern North America.** Boore, D.M.; Atkinson, G.M. (Geological Survey, Menlo Park, CA (USA)). Aug 1987. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016089/JAW. (CONF-8703282—).

From Earthquake ground-motion estimation in Eastern North America; Palo Alto, CA, USA (31 Mar 1987).

Boore and Atkinson (1987) described predictions of ground motion in eastern North America. One aspect of these predictions was the relation between magnitudes determined from Lg waves and from seismic moment. In this note the authors provide details on this relation not given in the previous paper. They also discuss the predictions of ground motions at rock sites in eastern and western North America using the stochastic model. In general, the motions are similar, but the presence of region-dependent whole path attenuation and the stress parameter, as well as differences in the competency of the rock underlying the sites (which they assume is expressed as differences in local site amplification and in the decay of high frequency spectral amplitudes) leads to differences which are a function of distance, oscillator period (for response spectral predictions), and magnitude. The final topic covered in this note is the implication of Boatwright and Choy's recent work on spectral scaling relations for intraplate earthquakes; their scaling leads to ground motion predictions as much as a factor of three lower than those in Boore and Atkinson.

57653 (EPRI-NP—5875, pp 17.1-17.37) **Magnitude and distance scaling of response spectral shapes for rock sites with applications to North American tectonic environments.** Silva, W.J.; Green, R.K. (Woodward-Clyde Consultants, Oakland, CA (USA)). Aug 1987. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016089/JAW. (CONF-8703282—).

From Earthquake ground-motion estimation in Eastern North America; Palo Alto, CA, USA (31 Mar 1987).

The response spectral shape, defined as the absolute response spectrum divided by the peak acceleration, represents the frequency content of the ground motion. Response spectral shapes estimated from a band limited white noise (BLWN) model compare favorably with spectral shapes of recorded ground motion in Western North America (WNA). The spectral shapes estimated for Eastern North America (ENA) are consistent with regression analyses performed by others for the region. The BLWN model was used to estimate magnitude and distance scaling of response spectral shapes using

appropriate source and path parameters. The spectral shapes are highly dependent on the maximum frequency, f/sub max/. Maximum spectral amplification is weakly dependent upon earthquake magnitude, but spectral amplification at long periods is highly dependent upon magnitude. The effect of distance on spectral shape is generally weak at distances less than 50 km in WNA and at distances less than 100 km in ENA. Realistic time histories, appropriate for WNA and ENA, can be produced by combining the amplitude spectrum from the BLWN model with the phase spectrum from a recorded accelerogram. 32 references, 15 figures, 6 tables.

57654 (EPRI-NP—5875, pp 18.1-18.42) **Wave propagation modeling of ground motion attenuation in the northeastern United States and adjacent Canada.** Barker, J.S.; Somerville, P.G.; McLaren, J.P. (Woodward-Clyde Consultants, Pasadena, CA (USA)). Aug 1987. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016089/JAW. (CONF-8703282—).

From Earthquake ground-motion estimation in Eastern North America; Palo Alto, CA, USA (31 Mar 1987).

In this study, the authors have used their understanding of the physics of elastic wave propagation to simulate ground motions within 100 km from earthquakes in eastern North America. Detailed crustal velocity structure models were developed for sources located in the Grenville and Appalachian provinces. Semi-empirical synthetic seismograms were computed by convolving the generalized ray response of the structures with an empirical source function obtained from a recording close to the source. Peak ground motions derived from the synthetic seismograms adequately interpolate the sparse empirical data, while providing information on the wave propagation phenomena that define ground motion attenuation. They suggest that ground motion amplitudes are controlled by (in order of increasing range) the upgoing, direct S wave, the diving S wave, post-critical reflections from the mid-crustal or Moho discontinuities, and finally, Lg. The shape of the attenuation curve is dependent on the relative amplitudes and interference of these ray types, and so is particularly sensitive to the gross crustal velocity structure and the source depth. The effect of source mechanism is secondary. For the point source cases studied, magnitude and near-receiver sediments affect the amplitudes of ground motions, but do not alter the shape of the attenuation curve. The common practice of combining ground-motion data from different crustal structures or source depths will smear out the details of the attenuation curves, increasing their uncertainty. Using attenuation curves appropriate for a particular region and depth, however, should reduce the uncertainty in ground-motion estimates for that region. 13 references, 27 figures.

57655 (EPRI-NP—5875, pp 19.1-19.3) **Comments on Practical strong motion prediction for eastern North America.** Helmberger, D.V. (California Institute of Technology, Pasadena (USA)). Aug 1987. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016089/JAW. (CONF-8703282—).

From Earthquake ground-motion estimation in Eastern North America; Palo Alto, CA, USA (31 Mar 1987).

Considerable progress has been made in strong motion prediction capabilities with the theoretically based stochastic model initially developed by Hanks and his colleagues. Various versions of the basic closed-form model require some calibration to a given region. In eastern North America the model is primarily tied to L/sub g/ waves recorded at relatively large distances. Since L/sub g/ is a widely studied phase in eastern North America, it provides a robust calibration of the stochastic theory at the larger distances. The transition from R/sup -1/2/ to R^{-1} geometrical spreading, based on the idea that L/sub g/ decays slower than body waves, has been set at R = 100 km. It is at the closer distances where, perhaps, the more deterministic approaches could have an impact, especially in answering what if questions. The question of asperity distribution can be addressed in a natural fashion using the more numerical methods where we no longer require events to be point sources or have whole-space Green's functions with 1/R falloff. Finite features are treated using summation operators, and path effects are treated using convolutions. Increasing the amplitude of high frequency energy in relation to seismic moment, if warranted by studies of source characteristics, is easily accomplished by the simulation procedure. The synthetic strong motion records obtained from this hypothesis testing could be compared against the predictions of random process models, and new calibration constants established. Following such a procedure would indicate to a large extent the ground motion consequences of asperity-based models and the effects of possible differences in asperity characteristics between eastern and western North America.

57656 (EPRI-NP—5875, pp 20.1-20.5) **Summary comments: practical ground motion estimates.** Campbell, K.W. (Geological Survey, Golden, CO (USA)). Aug 1987. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016089/JAW. (CONF-8703282—).

From Earthquake ground-motion estimation in Eastern North America; Palo Alto, CA, USA (31 Mar 1987).

The question addressed in this session is DO they have practical methods for predicting strong ground motion from moderate-to-large earthquakes in Eastern North America (ENA)? The answer is a qualified yes. They do have methods that are accepted and currently being applied by the seismological and engineering community, but each of these methods have imperfections that limit their reliability. In the remainder of this paper, the author briefly discusses the strengths and weaknesses of each of the methods discussed in this workshop and comes to some conclusion regarding their relative usefulness and reliability.

57657 (EPRI-NP—5875, pp 21.1-21.6) **Summary comments on ENA ground motion estimation.** McLaughlin, K.L. (Teledyne-Geotech, Alexandria, VA (USA)). Aug 1987. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016089/JAW. (CONF-8703282—).

From Earthquake ground-motion estimation in Eastern North America; Palo Alto, CA, USA (31 Mar 1987).

This paper summarizes research on ground motion prediction presented at the workshop. Recommendations are made as to how regional Q values should be used in ground motion estimation. Site responses and measuring methods are reviewed. The author feels it is important to distinguish between crustal and soil effects when discussing site effects.

57658 (EPRI-NP—5875, pp 22.1-22.8) **Toward a standard ground-motion estimation model for eastern North America.** Hanks, T.C. (Geological Survey, Menlo Park, CA (USA)). Aug 1987. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016089/JAW. (CONF-8703282—).

From Earthquake ground-motion estimation in Eastern North America; Palo Alto, CA, USA (31 Mar 1987).

The basics, of a Standard Model for Ground-Motion Estimation in Eastern North America are very simple, at least for $M \leqq 6\text{-}1/2$ and $R \leqq 100$ km and exclusive of local site response: a point-source, constant stress drop ($\delta\sigma = 100$ bars) excitation model, with some provision for stochastic generation of high-frequency radiation, and 1/R geometrical spreading. With this as a standard, remaining discrepancies can be explored in terms of site effects or perhaps some combination of site effects and variable $\Delta\sigma$. But there is less simplicity to this prescription than meets the eye, and several issues are discussed.

57659 (PNL-SA—16165) **Radiometric calibration of Landsat Thematic Mapper.** Wukelic, G.E.; Gibbons, D.E.; Martucci, L.M.; Foote, H.P. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1988. Contract AC06-76RL01830. 32p. (CONF-8808135—1). NTIS, PC A03/MF A01. Order Number DE88015927/JAW.

From NASA landsat workshop; Greenbelt, MD, USA (22 Aug 1988).

Absolute calibration of satellite-acquired data is essential for quantification of scientific studies and a variety of image- processing applications. This paper describes a multiyear, on-orbit radiometric calibration of the Landsat Thematic Mapper (TM). Primary emphasis was placed on TM band 6 (thermal) calibration, but selected reflectance-band calibration measurements were also made.

Twenty-five Landsat TM coverages were acquired, and included day, night, and seasonal scenes at several geographical locations. Concurrent with Landsat overpasses, thermal and reflectance field and local meteorological (surface and radiosonde) measurements were collected. At-satellite (uncorrected) radiances and temperatures for water and non-water land cover were compared to ground truth (GT) measurements after making adjustments for atmospheric (using LOWTRAN), mixed-pixel, and emissivity effects. Results indicate that for well-characterized water features, TM band 6 average corrected temperature determinations using local radiosonde data for atmospheric adjustments are within ≦0.6{degree}C of GT temperature determinations. For non-water features, TM band 6 derived temperatures are within 1{degree}C of GT temperature determinations, if appropriate emissivity adjustments are made. Corrections using non-local radiosonde data resulted in errors as large as 12{degree}C. Corrections using the US Standard atmosphere gave temperature values within 1 to 2{degree}C of GT. The average uncertainty for field instruments was +-0.2{degree}C; average uncertainty for Landsat TM corrected temperature determinations was +-0.4{degree}C. A cross-calibration of TM band 6 and the Advanced Very High Resolution Radiometer (AVHRR) for a Landsat overpass gave similar temperature results. 15 refs., 3 figs., 5 tabs.

57660 (RF/PRC/T—5/87) Structure of mantle and lithosphere inferred from post-glacial uplift. Fjeldskaar, W.; Cathles, L. (Rogalandsforskning, Stavanger (Norway)). Jun 1987. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754876/JAW.

The earth's response to glacial loading/unloading offers exceptional promise for the study of the physical properties of the lithosphere and mantle. The observational data presently available in Fennoscandia are sufficient to reveal informations on the structure of the earth's uppermost parts. In fact, the theoretical adjustment behaviors for different assumptions of lithosphere and mantle rheology are quite unlike. The earth's response to the observed deglaciation history is predicted using a 3-D viscoelastic model, in which the mantle viscosity and lithosphere thickness is allowed to vary. Agreement with the uplift data is achieved by a lithosphere thickness of 90 km, a 75km channel of viscosity 0,7 x 10/sup 2/0 poise in the upper mantle, and a low viscosity lower mantle. 14 drawings, 19 references.

57661 Biot number and thermos bottle effect: implications for magma-chamber convection. Carrigan, C.R. (Sandia National Labs., Albuquerque, NM (USA)). *Geology;* **16**: No. 9, 771-774(Sep 1988). Contract AC04-76DP00789.

Thermal boundary conditions model the coupling between a convecting magmatic body and its host. Such conditions need to be considered in models of igneous systems that involve thermal histories, crystallization and fractionation of melt, formation of aureoles by contact metamorphism, and any other processes in which transport of heat plays a role. Usually, investigations of magmatic systems have tended to emphasize modeling the interior convective regime relative to treatment of the thermal coupling. Yet it is found that the thermal nature of an intrusion is likely to be influenced more by coupling to its host than by the details of internal convective flows. Evaluation of a parameter having the form of a Biot number (Bi) provides a basis for estimating which boundary conditions are most appropriate. It is found that Bi ≦ 0.1 (constant heat-flux limit) for models of several caldera systems. For such values of the Biot number, the host regime behaves somewhat like a thermos bottle by limiting the flow of heat through the magma-host system so that convective stirring of magma has little effect on the cooling rate of the intrusion. Because of this insulating effect, boundary temperatures assumed in convection models should approach magmatic values even if an active hydrothermal system is present. However, high boundary temperatures do not imply that melting and assimilation of host rock by magma must occur. Despite the thermos bottle effect, magmatic convection can still be quite vigorous.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 56184

57662 (IKU-R—08.2685.00/02/87) Wettability of reservoir rocks. Annual report. Selle, O.M.; Hjelmeland, D.; Nordby, B. (Institutt for Kontinentalundersoekelser og Petroleumsteknologi A/S, Trondheim (Norway)). Feb 1987. 14p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754856/JAW.

Techniques have been developed to measure contact angles of clay minerals and to prepare unconsolidated reservoir cores for Amott- tests. The contact angle method and the Amott method give results in relatively good agreement in ideal systems. In systems where the oil wetting is due to oil wetting minerals or insoluble organic coating, the contact angle method is not quite satisfactory. But in most cases the oil wetting is due to absorption from the oil phase. The contact angle method is applied where the effect of fluid composition, pressure and temperature on the wetting of solid matter is to be studied. Different reservoir minerals give different wetting, and for some minerals the wetting is dependent on the temperature. 7 refs., 4 figs.

57663 (STF—36A87105) Hydraulic splitting. Testing in the Brattset hydroelectric power station. Hansen, S.E.; Hanssen, T.H. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). Nov 1987. 29p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754906/JAW.

The report presents the methods and results from the hydraulic splitting experiments in connection with the testing of rock mechanics at the hydroelectric power station of Brattset in the county of Soer-Troendelag (Norway). The splitting pressure varies between 47 and 56 bar. The in situ tensile strength is 70 bar. 6 drawings, 4 tables.

5804 Geochemistry

REFER ALSO TO CITATION(S) 56191, 56192, 56193, 56194, 57083, 57094

57664 (EPRI-EA—5872) Thermochemical data used by the FASTCHEM package: Final report. Krupka, K.M.; Erikson, R.L.; Mattigod, S.V.; Schramke, J.A.; Cowan, C.E. (Electric Power Research Inst., Palo Alto, CA (USA); Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 231p. NTIS, PC A11/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number DE89000286/JAW.

The FASTCHEM (Fly Ash and FGD Sludge Transport and Geochemistry) computational package simulates the subsurface transport of solutes, encompassing hydrology and geochemistry in a series of related by independent modules. The FASTCHEM package comprises the hydrological codes EFLOW and ETUBE, the geochemical code ECHEM, the coupled geohydrochemical transport code EICM, and their associated file processor codes. This document describes the geochemical data used by the FASTCHEM package. The geochemical data discussed in this report were categorized as measured thermochemical data, estimated ion-exchange and specific-ion adsorption data, and measured kinetic data. The measured thermochemical (i.e., aqueous speciation and solubility) data have been derived primarily from the existing MINTEQ thermochemical database and modified using thermodynamic data compiled and measured as part of EPRI Projects RP2485-3 and RP2485-8. In establishing the database for the FASTCHEM package, the reactions and rate constants were checked for consistency. Identifiers denoting the sources of the data were added. Interim models describing ion-exchange and specific-ion adsorption reactions were included in the FASTCHEM database. The ion-exchange database was developed for reactions on smectite clays as a framework for estimating thermochemical data that are not yet available. The specific-ion adsorption database includes reactions for the adsorption of selected elements on hydrous ferric oxide. 159 refs., 26 figs., 21 tabs.

57665 **(PB—88-229752/XAB) Leaching of domestic manganese ores with dissolved SO_2. Report of investigation/1988.** Pahlman, J.E.; Khalafalla, S.E. (Bureau of Mines, Twin Cities, MN (USA). Twin Cities Research Center). 1988. 22p. (BM-RI—9150). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600301.

The Bureau of Mines conducted column-leaching tests on 25 domestic Mn ores to determine the feasibility of extracting Mn by in-situ or heap leaching with dissolved sulfur dioxide (SO_2) solutions. Dissolved SO_2 was found to be effective for leaching Mn; extractions greater than 90% were obtained with solution application rates of 1 mL/min from uncalcined, minus 2.5- plus 1.3-cm ore pieces. The rate of leaching was found to be principally dependent upon the rate at which the leaching solution can penetrate the ore, since the solubilization of Mn upon contact with SO_2 was observed to be rapid. It appears, therefore, that leaching Mn opens up the pores, allowing penetration of the leach solution into the ore pieces.

57666 **(PB—88-229836/XAB) Dual-leaching method for recovering silver and manganese from domestic manganiferous silver deposits. Report of Investigations/1987.** Pahlman, J.E.; Rhoades, C.A.; Chamberlain, P.G. (Bureau of Mines, Twin Cities, MN (USA). Twin Cities Research Center). 1987. 15p. (BM-RI—9126). NTIS, PC A03/MF A01.

Library of Congress catalog card no. 87-600135.

A dual-leaching method that offers the potential for the economic recovery of the silver and manganese contained in some domestic manganiferous silver deposits was studied. The method consists of an initial leach of manganese with aqueous sulfur dioxide (SO_2) followed first by a neutralization rinse, and then by a second leach with cyanide solution for the extraction of silver. Refractory silver in these ores was either (1) intimately associated with the manganese, (2) chemically resistant to cyanide leaching, or (3) rendered inaccessible to cyanide leach solution by the surrounding manganese mineralization. Less than 10% of the silver was extracted when minus 2.5-plus 1.3-cm ore pieces were leached directly with cyanide. However, extractions of 25 to 82% of the silver and 65 to 96% of the manganese were attained in laboratory column-leach tests using the dual-leaching method on equivalent-sized ore pieces from seven domestic deposits.

64 PHYSICS I

REFER ALSO TO CITATION(S) 57898

57667 **(INIS-SU—42) Experimental and theoretical physics. Collection.** Basov, N.G. (ed.). (AN SSSR, Moscow. Fizicheskij Inst.). 1987. 49p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89780009/JAW.

Individual papers in this collection are indexed separately.

57668 **(INIS-SU—44/A) Experimental and theoretical physics. Collection.** Basov, N.G. (ed.). (AN SSSR, Moscow. Fizicheskij Inst.). 1987. 61p. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780010/JAW.

Individual papers in this collection are indexed separately.

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 57805, 57891

57669 (CONF-8704112—, pp 387-388) **Are AMS ^{7}Be measurements for a lithium solar neutrino detector practical?.** Fireman, E.L.; Litherland, A.E.; Rowley, J.K. (Smithsonian Astrophysical Observatory, Cambridge, MA (USA)). 1987. Elsevier Science Publishers Co. Inc., 52 Vanderbilt Ave., New York 10017. Order Number TI88013520/JAW.

From 4. international symposium on accelerator mass spectrometry; Ontario, Canada (27 Apr 1987).

An efficient, low-background method of measuring ^{7}Be is necessary to make a solar neutrino detector using lithium practical. Accelerator mass spectrometric ^{7}Be measurements with BeO sputter sources are inefficient because of the small molecule (atom) to ion conversion. By collecting the sputtered BeO, that has not been accelerated, on an aluminum electrode and preparing additional sources from the collected Be, the overall efficiency might be raised sufficiently so that a lithium solar neutrino detector would be practical.

57670 **(EFI—952(2)-87) Absolute spectrum of 1 TeV hadrons 700g/cm/sup 2/ deep in the atmosphere.** Avakyan, V.V.; Mamidzhanyan, E.A.; Ovsepyan, G.G.; Pleshko, M.P.; Ter-Antonyan, S.V. (Erevanskij Fizicheskij Inst. (USSR)). 1987. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704315/JAW.

The absolute differential energy spectra of charged and neutral hadrons are presented with account of electron accompaniment density in hadron energy range 1-5 TeV. Experimental data are obtained at the 'Pion' installation mounted 700 g/cm/sup 2/ above the sea level. The results are given in comparison with well-known data and agree with theoretical Monte Carlo values. A two-component model of interaction of hadrons with inclusive spectra is used in calculations. These inclusive spectra are given by the quark-gluon string theory. 7 refs.; 5 figs.

57671 **(EFI—968(18)-87) What topology could be the Universe created with?.** Gurzadyan, V.G.; Kocharyan, A.A. (Erevanskij Fizicheskij Inst. (USSR)). 1987. 24p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704321/JAW.

In the framework of Hawking quantum cosmology the topological and geometrical properties of a created Universe with cosmological constant are considered. Probabilities for the Universe creation with different topologies (including torus, sphere, hyperbolic space) are calculated. These topologies turned out to be equally probable for the case of inflationary Universe. For the considered model the probability for the quantum change of topology during the Universe evolution is calculated. 25 refs.

57672 **(EFI—984(34)-87) On the transparency of the metagalaxy to ultrahigh-energy gamma rays.** Aharonyan, F.A.; Vardanyan, V.V. (Erevanskij Fizicheskij Inst. (USSR)). 1987. 24p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704324/JAW.

The electron-photon shower production in the field of the microwave background radiation (MBR) is considered. The absolute flux of ultrahigh-energy cascade gamma-rays (E>or approx.5X10/sup 19/eV), resulting from the PI-meson photoproduction in the field of the MBR is obtained. 22 refs.; 2 figs.

57673 **(EFI—985(35)-87) Possibilities for the search for cosmic ray anisotropy on the Pion Installation.** Martirosyan, G.S.; Ovsepyan, G.G.; Ter-Antonyan, S.V. (Erevanskij Fizicheskij Inst. (USSR)). 1987. 16p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704325/JAW.

It is proposed to search for cosmic ray anisotropy on the basis of experimental data from the "PION" installation which registers hadrons with energies 0.5-30 TeV and also hadron groups in the direction of galactic sources Cygnus X- and Hercules-1. It is for the first time suggested to investigate the cosmic ray spectra from the point of view of direction anisotropy. 10 refs.; 3 figs.; 2 tabs.

57674 (INIS-BR—1229, pp 95) **Cancellation of magnetic flux. I - On the quiet sun.** Livi, S.H.B.; Wang, J.; Martin, S.F. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Beijing Observatory (China); California Inst. of Tech., Pasadena (USA)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57675 (INIS-BR—1229, pp 96) **Cancellation of magnetic flux. II - In a decaying active region.** Martin, S.F.; Livi, S.H.B.; Wang, J. (California Inst. of Tech., Pasadena, (USA); Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Beijing Univ. (China)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.
In Progress Report 1985-1986.

57676 (INIS-BR—1229, pp 98) **HII region age indicators.** Copetti, M.V.F.; Pastoriza, M.G.; Dottori, H. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.
In Progress Report 1985-1986.

57677 (INIS-BR—1229, pp 98) **Photometric measurements of WH/sub β/ and [OIII]/H/sub β/ of HII regions in M83.** Copetti, M.V.F.; Dottori, H.; Pastoriza, M.G. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.
In Progress Report 1985-1986.

57678 (INIS-BR—1229, pp 99) **Comparative study of the stellar content in normal and active nuclei of spinal galaxies.** Dottori, H.; Pastoriza, M.G. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.
In Progress Report 1985-1986.

57679 (INIS-BR—1229, pp 102) **Ages and metallicities of LMC and SMC red clusters through H/sub β/ and G band photometry.** Bica, E.L.D.; Dottori, H.; Pastoriza, M.G. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.
In Progress Report 1985-1986.

57680 (INIS-BR—1229, pp 106) **NGC 2209: the nature of the dark patch.** Dottori, H.; Melnick, J.; Bica, E.L.D. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.
In Progress Report 1985-1986.

57681 (INIS-BR—1229, pp 109) **Photometric studies of Southern open clusters, II: NGC 3766 and NGC 5460.** Costa, R.D.D.; Ducati, J.R.; Pastoriza, M.G. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.
In Progress Report 1985-1986.

57682 (INIS-BR—1229, pp 109) **Multicolor photometry of three Southern open clusters.** Costa, R.D.D. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.
In Progress Report 1985-1986.

57683 (INIS-BR—1229, pp 113) **Measurement of secular evolution in the pre-white dwarf star PG 1159-035.** Wingel, D.E.; Robinson, E.L.; Nather, R.E.; Kepler, S.O.; O'Donoghue, D. (Texas Univ., Austin (Brazil). Dept. of Astronomy; Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Cape Town Univ. (South Africa)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.
In Progress Report 1985-1986.

57684 (INIS-BR—1229, pp 113) **Most recent value for the rate of period change in the ZZ CETI star G117-B615A.** Kepler, S.O.; Winget, D.E.; Robinson, E.L.; Nather, R.E. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Texas Univ., Austin (USA). Dept. of Astronomy). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.
In Progress Report 1985-1986.

57685 (INIS-BR—1229, pp 114) **Comparison between optical and x-ray simultaneous observations of the variable prewhite dwarf star PG1159-035.** Kepler, S.O.; Winget, D.E.; Barstow, M. and others. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Texas Univ., Austin (USA). Dept. of Astronomy; Earth and Space Science Inst., Tucson, AZ (USA)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.
In Progress Report 1985-1986.

57686 (INIS-BR—1229, pp 99) **Spectrophotometry of the nucleus of NGC 7552.** Dottori, H.; Pastoriza, M.G.; Landaberry, S.C.; Freitas Pacheco, J.A. de. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.
In Progress Report 1985-1986.

57687 (INIS-BR—1229, pp 100) **BV surface photometry of Southern galaxies I- NGC 4507.** Bergmann, T.S.; Pastoriza, M.G. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.
In Progress Report 1985-1986.

57688 (INIS-BR—1229, pp 100) **BV surface photometry of the Southern Galaxies NGC 6769, 6770 and 6771.** Bergmann, T.S.; Schroeder, M.F.S.; Pastoriza, M.G. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.
In Progress Report 1985-1986.

57689 (INIS-BR—1229, pp 101) **Color gradients in globular clusters.** Pastoriza, M.G.; Bica, E.L.D.; Copetti, M.V.F.; Dottori, H. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.
In Progress Report 1985-1986.

57690 (INIS-BR—1229, pp 102) **Distribution of interstellar extinction near the sun.** Ducati, J.R. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.
In Progress Report 1985-1986.

57691 (INIS-BR—1229, pp 103) **Galaxies with strong nitrogen lines.** Bergmann, T.S.; Pastoriza, M.G. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.
In Progress Report 1985-1986.

57692 (INIS-BR—1229, pp 104) **Nuclear stellar population of NGC 772 (ARP 78).** Schmidt, A.A.; Dottori, H. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.
In Progress Report 1985-1986.

57693 (INIS-BR—1229, pp 104) **BV surface photometry of the Southern Galaxies NGC 2855 and NGC 4507.** Bergmann, T.S.; Pastoriza, M.G.; Schroeder, M.F.S. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.
In Progress Report 1985-1986.

57694 (INIS-BR—1229, pp 105) **Morphology of LMC clusters.** Zepka, A.F.; Dottori, H. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.
In Progress Report 1985-1986.

57695 (INIS-BR—1229, pp 107) **Evolution of HII regions.** Dottori, H. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.
In Progress Report 1985-1986.

57696 (INIS-BR—1229, pp 107) **Age determination of the Magellanic clouds and isolated extragalactic HII regions.** Copetti, M.V.F.; Dottori, H.; Pastoriza, M.G. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57697 (INIS-BR—1229, pp 108) **Search for periodicities in the light variation of some seyfert galaxies.** Bisch, S.M.; Pastoriza, M.G.; Dottori, H.; Busko, I. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57698 (INIS-BR—1229, pp 110) **Spectrophotometry of the nuclei of NGC 772 and NGC 5325.** Schmidt, A.A. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57699 (INIS-BR—1229, pp 110) **Galaxies with strong nitrogen lines.** Bergmann, T.S.; Pastoriza, M.G. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57700 (INIS-BR—1229, pp 97) **Average density of the universe and the Regge low.** Schmidt, A.A.; Dottori, H.; Vasconcellos, C.A.Z. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57701 (INIS-BR—1229, pp 103) **Strip photometry of comet Halley.** Ducati, J.R.; Bergmann, T.S.; Bevilacqua, C.M. and others. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57702 (INIS-BR—1229, pp 106) **Cosmological mass density and the Regge low.** Schmidt, A.A.; Vasconcellos, C.A.Z.; Dottori, H. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57703 **(ITP—87-59) Origin and dynamics of expanding neutral hydrogen supershells.** Kolesnik, I.G.; Silich, S.A. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1987. 21p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704372/JAW.

The evolutionary model of expanding supershells regulated by induced star formation is proposed. It is suggested that giant expanding shells are formed n superclouds at late evolutionary stage of star complexes. To understand the dynamics of the most huge supershells it is necessary to take into account that expanding shells can trigger star formation in cold dense pre-exosting cloudlets. Efficiency of induced star formation must be less than one percent to fit observational properties of supershells. 46 refs.; 6 figs.

57704 **(LA-UR—88-2927) The Baksan Neutrino Observatory Soviet-American Gallium Solar Neutrino Experiment.** Abazov, A.I.; Abdurashitov, D.N.; Anosov, O.V.; Avdeyev, A.V.; Belouska, Yu. I.; Bychuk, O.V.; Danshin, S.N.; Eroshkina, L.A.; Faizov, E.L.; Gavrin, V.N. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 15p. (CONF-8806204—4). NTIS, PC A03/MF A01. Order Number DE89000375/JAW.

From 13. international conference on neutrino physics and astrophysics; Boston, MA, USA (5 Jun 1988).

A radiochemical ^{71}Ga-^{71}Ge experiment to determine the integral flux of neutrinos from the sun is currently under preparation at the Baksan Neutrino Observatory in the USSR. Measurements are scheduled to commence by late 1988 with 30 tonnes of metallic gallium. A fractional statistical accuracy of 18% is expected to be obtained after one year of operation if the solar signal obtained after one year of operation if the solar signal is 70 SNU, the flux expected from p-p neutrinos alone. While initial measurements are in progress, 30 additional tonnes of gallium will be installed in order to perform the full experiment with a 60-tonne target. 28 refs.

57705 **(LA-UR—88-3177) Nuclear astrophysics from neutron cross-section measurements on radiactive samples.** Koehler, P.E.; O'Brien, H.A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 15p. (CONF-881151—3). NTIS, PC A03/MF A01. Order Number DE89000316/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

Reaction rates for both big-bang and stellar nucleosynthesis calculations can be obtained from the measurement of (n,p) (n, α) and (n,γ) cross sections for radioactive nuclei. In the past, large backgrounds associated with the sample activity limited these types of measurements to radioisotopes with very long half lives. The advent of the high-intensity neutron source at the Los Alamos Neutron Scattering CEnter (LANSCE) has greatly increased the number of nuclei which can be studied. Results of recent measurements on samples with half lives as short as fifty-three days are given. Plans for future measurements are discussed. 32 refs., 3 figs.

57706 **(LA-UR—88-3219) Solar-like oscillations in late spectral class stars.** Cox, A.N.; Cahn, J.H. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 6p. (CONF-8809146—2). NTIS, PC A02/MF A01. Order Number DE89000321/JAW.

From Seismology of the sun and sun-like stars; Puerto de la Cruz, Spain (26 Sep 1988).

We investigate the minimum mass star that can exhibit solar-like nonradial p-mode oscillations. Solar models have almost equal pulsational driving and damping due to standard radiative effects. Coupling with surface convective elements occasionally tips the balance by strongly driving for a few days modes with convection timescales at the top of the convection zone. Then both convective and radiative damping decrease the mode amplitude at an observed decay rate, until the next convective reexcitation. Population I stellar models at 0.30, 0.45, and 0.75 Msub solar have been constructed to see if they have a near equality of radiative driving and damping also. If so, then stars down to late spectral class could possibly display solar-like oscillations. We find that the near equality of radiative driving and damping occurs down to about 0.5sub solar. Possibly 100 to 300 second oscillations can be observed through most of the K spectral class, if magnetic activity does not overwhelm these small amplitude nonradial pulsations. 24 refs., 6 figs., 6 tabs.

57707 **(LA-UR—88-3271) Oscillation frequencies of solar models.** Cox, A.N.; Guzik, J.A.; Kidman, R.B. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 6p. (CONF-8809146—1). NTIS, PC A02/MF A01. Order Number DE89000308/JAW.

From Seismology of the sun and sun-like stars; Puerto de la Cruz, Spain (26 Sep 1988).

Two solar models have been constructed, one with no diffusion of the atomic nuclei, and another including diffusive element separation. The opacity at the bottom of the convection zone was increased 15--20 percent (within its theoretical uncertainty) to obtain a few microhertz agreement with observed p-mode frequencies. Original helium mass fractions were 0.291 and 0.289 for the no-diffusion and diffusion models, respectively. The diffusion model evolved to a surface Y = 0.256 at the solar age, and the original Z value of 0.0200 decreased to 0.0179. Agreement of l = 0 and 2 p-mode frequency separations with those observed is good. The g-mode nonadiabatic solutions do not have equal period spacing until high radial order. The lowest order modes are more visible if they all have the same kinetic energy. High central temperatures, produce over 9 SNUs from the B and 1.5 SNUs from the Be reactions. Models with iron condensed-out below the convection zone, and with WIMPs cooling the central regions to reduce the SNUs, agree less well with p-mode frequency separations. 53 refs., 6 figs., 4 tabs.

57708 **(LBL—25726) Detection of dark matter particles with low temperature phonon sensors.** Sadoulet, B. (Lawrence Berkeley Lab., CA (USA)). Mar 1988. Contract AC03-76SF00098. 10p. (CONF-8803109—8). NTIS, PC A02/MF A01. Order Number DE89001252/JAW.

From 23. Rencontre de Moriond conference: electroweak interactions and unified theories; Les Arcs, France (6 Mar 1988).

Taking as an example the development effort in Berkeley, the author discusses for nonspecialists (Astronomers and Particle Physicists) the promises of phonon sensing at low temperature for the detection of dark matter particles and the difficulties faced. 31 refs.

57709 **(NBI-HE—88-18) Superconducting cosmic strings and W condensation.** Ambjoern, J.; Olesen, P.; Nielsen, N.K. (Niels Bohr Inst., Copenhagen (Denmark); Odense Univ. (Denmark). Fysisk Inst.). (Niels Bohr Inst., Copenhagen (Denmark); Niels Bohr Inst., Copenhagen (Denmark); Odense Univ. (Denmark). Fysisk Inst.). Apr 1988. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755246/JAW.

We show that the linearized field equations for W-bosons are unstable in the presence of a strong magnetic field from a superconducting cosmic string.

57710 **(NBI-HE—88-38) Baryon asymmetry generation in the electroweak theory. A lattice study.** Ambjoern, J.; Laursen, M.L.; Shaposhnikov, M.E. (Niels Bohr Inst., Copenhagen (Denmark); Mainz Univ. (Germany, F.R.). Inst. fuer Physik; AN SSSR, Moscow. Inst. Yadernykh Issledovanij). (Niels Bohr Inst., Copenhagen (Denmark); Niels Bohr Inst., Copenhagen (Denmark); Mainz Univ. (Germany, F.R.). Inst. fuer Physik; AN SSSR, Moscow. Inst. Yadernykh Issledovanij). 1988. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755248/JAW.

We study the baryon asymmetry generation within the framework of the standard electroweak theory. The assumed first order finite temperature phase transition to the spontaneously broken phase is simulated on the lattice. The Monte Carlo data suggest that the high temperature plasma is populated with gauge-Higgs fluctuations, which produce a change Q in the Chern-Simons number during the transition, thereby creating fermions due to the electroweak anomaly. We provide evidence and arguments in favour of a uniform distribution of Q. This being the case, the baryon asymmetry produced during the phase transition is large enough to explain the asymmetry observed today.

57711 **(PB—88-224886/XAB) Physics of the sun.** (National Academy of Sciences, Washington, DC (USA). Commission on Physical Sciences, Mathematics, and Resources). 1985. 69p. NTIS, PC A04/MF A01.

The Space Science Board undertook the study of solar physics at the request of the National Aeronautics and Space Administration (NASA) to help guide the agency's future program. Specifically, the authors were asked to address the following questions: What is the scientific content of solar physics. What should be the future scientific directions. What should be the appropriate role of NASA in solar physics. A Study Panel was assembled, composed of members with broad scientific interests, and an Advocacy Panel, composed of practicing solar physicists and scientists with related interests. The purpose of the panel was to obtain an impartial assessment of the scientific content of the field, to identify the critical issues of solar physics, and to mobilize its practitioners to develop plans for future investigations.

57712 **(PB—88-232970/XAB) Strategy for the Explorer program for solar and space physics.** (National Academy of Sciences, Washington, DC (USA). Commission on Physical Sciences, Mathematics, and Resources). 1984. 52p. NTIS, PC A04/MF A01.

Contents include: executive summary; the Explorer program - background and current status; strategy - level of activity; solar-terrestrial research (solar physics, space plasma physics, and upper atmospheric physics).

57713 **(UCRL—98174) A general purpose calibration facility for use in x-ray astronomy.** Craig, W.W.; Hailey, C.J.; Morales, R.I.; Kahn, S.M.; Wargelin, B.J. (Lawrence Livermore National Lab., CA (USA)). 11 Aug 1988. Contract W-7405-ENG-48. 10p. (CONF-880887—16). NTIS, PC A02/MF A01. Order Number DE88017021/JAW.

From 32. international technical symposium on optical and opto-electronic applied sciences and engineering; San Diego, CA, USA (14 Aug 1988).

An x-ray calibration facility for use in the 0.2–25 keV region is described. The facility employs several types of specially modified sources and detectors to produce and detect both line and continuum radiation in this energy range. We describe an inexpensive commercial x-ray source which has been modified for efficient high intensity operation as well as production of x-rays up to 25 keV. We also describe a system that utilizes multilayer mirrors alone or in a double Bragg geometry to select an energy bandpass. This system is controlled by a microcomputer which translates and rotates the multilayers to provide an easily selectable monochromatic beam with good resolution over a broad energy range. A long focal length Kirkpatrick--Baez mirror pair has been coupled to a pivoting beam line in order to accurately characterize gratings for use in soft x-ray astronomy. The beam line is scanned through the various grating orders. All aspects of the facility incorporate high degree of flexibility so that a wide variety of calibrations can be easily performed. 12 refs., 5 figs.

57714 **(UCRL—98965) Radioactive beam studies of cosmological interest.** Sale, K.E.; Boyd, R.N.; Mathews, G.J.; Corn, P.B.; Islam, M.S. (Lawrence Livermore National Lab., CA (USA); Ohio State Univ., Columbus (USA). Dept. of Physics and Astronomy; Ohio State Univ., Columbus (USA)). 23 Sep 1988. Contract W-7405-ENG-48. 5p. (CONF-881151—12). NTIS, PC A02/MF A01. Order Number DE89001129/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

Experimental efforts by the LLNL/Ohio State radioactive ion beam collaboration are described. We are presently focusing on some reactions which are of great importance in the newly proposed inhomogeneous big bang cosmological models. Specifically we are using our system to make beams of ^{8}Li for measurements of the ^{8}Li(d,n)^{9}Be and ^{8}Li(α,n)^{11}B cross sections. These are the key reactions which determine the production of heavy ($A > 12$) elements during the era of big bang nucleosynthesis, and thus the initial composition of stars and subsequent stellar isotope production. Plans for future experiments, including the measurement of the ^{7}Be(p,γ)^{8}B cross section will be discussed. 5 refs.

57715 **(UCRL—99247) Evolution and mixing on the AGB.** Lattanzio, J.C. (Lawrence Livermore National Lab., CA (USA)). 27 Jul 1988. Contract W-7405-ENG-48. 22p. (CONF-8807108—1). NTIS, PC A03/MF A01. Order Number DE88017007/JAW.

From International Astronomical Union colloquium; Bloomington, IN, USA (27 Jul 1988).

It is now well known that Nature can make Carbon stars at lower luminosities than can (human) theorists. A number of workers, stimulated by this challenge, have been attracted to the problem. In this paper I review recent evolutionary models of relatively low mass AGB stars, with emphasis placed on the mixing of carbon to the stellar surface. In particular I discuss some recent improvements in the physics used to construct stellar models. These topics include: breathing pulses of the convective core found during exhaustion of the core helium supply; the effects of carbon recombination; the occurrence of semiconvection in the region between the two nuclear burning shells, and the importance of mass loss. It appears that different effects may operate at different stellar masses and abundances. Recent calculations have successfully produced models of low luminosity Carbon stars. The strengths and weaknesses of these models will be contrasted. 60 refs., 5 figs.

57716 **(UCRL—99411) Gamma rays from Cygnus X-1: New diagnostics for a black hole.** Liang, E.P. (Lawrence Livermore National Lab., CA (USA)). Aug 1988. Contract W-7405-ENG-48. 14p. (CONF-8804192—1). NTIS, PC A03/MF A01. Order Number DE88016275/JAW.

From NATO Advanced Study Institute conferrence on cosmic gamma rays and cosmic neutrinos; Erice, Italy (20 Apr 1988).

New gamma ray observations of Cygnus X-1, especially those with the HEAO-3 satellite, have revealed a transient bump in the 0.4 - few move region. Its successful interpretation in terms of the optically thin emission from a compact cloud of semi-relativistic plasma close to the black horizon has shed new light on the structure and dynamics of the accretion flow. Detailed spectral and temporal analyses of the HEAO and other gamma ray data may thus provide an important new diagnostic of black holes not obtainable with x-ray observations. This has important implications for both the theory and strategies of future high energy observation of black holes. 33 refs., 8 figs., 1 tabs.

57717 **Ultrahigh-energy pulsed emission from Hercules X-1 with anomalous air-shower muon production.** Dingus, B.L.; Alexandreas, D.E.; Allen, R.C.; Burman, R.L.; Butterfield, K.B.; Cady, R.; Chang, C.Y.; Ellsworth, R.W.; Goodman, J.A.; Gupta, S.K.; and others. (The University of Maryland, College Park, Maryland 20742). *Physical Review Letters;* **61**: No. 17, 1906-1909(24 Oct 1988).

A search for bursts of air-shower events from Hercules X-1 at energies above 50 TeV during the calendar period 2 April 1986 to 5 July 1987 yielded two significant bursts, both occurring on UT 24 July 1986. The events during these bursts were pulsed with a period of 1.235 68 s, significantly different from estimates of the contemporaneous x-ray period. The probability that this represents random statistical fluctuations of the background is estimated to be 2×10^{-5}. The muon content of the burst events is anomalous when compared with expectations from γ-ray showers.

57718 **Numerical rates for nucleon-nucleon, axion bremsstrahlung.** Brinkmann, R.P.; Turner, M.S. (Department of Astronomy and Astrophysics, Enrico Fermi Institute, The). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 8, 2338-2348(15 Oct 1988).

We numerically evaluate the axion emission rate from nucleon-nucleon, axion bremsstrahlung for arbitrary nucleon degeneracy(ies). Our numerical rates agree with analytical results previously derived in the degenerate and nondegenerate limits. While the conditions in the newly born, hot neutron star associated with SN1987A are semidegenerate, the nondegenerate, analytical rate is found to be a very good approximation (accurate to better than a factor of 2), while the degenerate, analytical rate overestimates axion emission by a factor of $\sim$20—100.

57719 **Gravitational radiation from type-II supernovae: The effect of the high-density equation of state.** Seidel, E.; Myra, E.S.; Moore, T. (McDonnell Center for the Space Sciences, Department of Physics, Washington). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 8, 2349-2356(15 Oct 1988).

Odd-parity gravitational perturbations of detailed spherically symmetric type-II supernova models, which include realistic equations of state and neutrino transport, are studied in the linearized Einstein theory. To investigate the parameters affecting gravitational-wave production during core collapse, we have performed simulations in which we vary the equation of state at supernuclear densities, the free proton mass fraction, and the precollapse iron core. These variations span much of the range of conditions currently thought to occur during stellar collapse and lead to the production of core-bounce shock waves that vary from the very strong to those that stall almost immediately. We find little difference in the gravitational radiation output among any of these models, though models that use stiffer equations of state or higher-mass iron cores give somewhat more radiation output.

57720 **Stability of boson stars.** Gleiser, M. (NASA/Fermilab Astrophysics Center, MS209 Fermi National Accelerator Laboratory, Box 500, Batavia, Illinois 60510). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 8, 2376-2385(15 Oct 1988).

Boson stars are gravitationally bound, spherically symmetric equilibrium configurations of cold, free, or interacting complex scalar fields phi. As these equilibrium configurations naturally present local anisotropy, it is sensible to expect departures from the well-known stability criteria for fluid stars. With this in mind, I investigate the dynamical instability of boson stars against charge-conserving, small radial perturbations. Following the method developed by Chandrasekhar, a variational base for determining the eigenfrequencies of the perturbations is found. This approach allows one to find numerically an upper bound for the central density where dynamical instability occurs. As applications of the formalism, I study the stability of equilibrium configurations obtained both for the free and for the self-interacting [with V(phi) = (λ/4)chemical bondphichemical bond^4] massive scalar field phi. Instabilities are found to occur not for the critical central density as in fluid stars but for central densities considerably higher. The departure from the results for fluid stars is sensitive to the coupling λ; the higher the value of λ, the more the stability properties of boson stars approach those of a fluid star. These results are linked to the fractional anisotropy at the radius of the configuration.

57721 **Cross sections, relic abundance, and detection rates for neutralino dark matter.** Griest, K. (Astronomy and Astrophysics Center, Enrico Fermi Institute, The University of Chicago, Chicago, Illinois 60637). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 8, 2357-2375(15 Oct 1988).

Neutralino annihilation and elastic scattering cross sections are derived which differ in important ways from previous work. These are applied to relic abundance calculations and to direct detection of neutralino dark matter from the galactic halo. Assuming the neutralino is the lightest supersymmetric particle and that it is less massive than the Z^0, we find relic densities of neutralinos greater than 4% of critical density for almost all values of the supersymmetric parameters. We constrain the parameter space by using results from the DESY e^+e^- storage ring PETRA (chargino mass less than 23 GeV) and the ASP detector at the SLAC storage ring PEP, and then assuming a critical density of neutralinos, display event rates in a cryogenic detector for a variety of models. A new term implies "spin-independent" elastic scattering even for these Majorana particles and inclusion of propagator momenta increases detection rates by 10—300 % even for pure photinos. Z^0-squark interference leads to very low detection rates for some values of the parameters. The new term in the elastic cross section dominates for heavy, mostly spinless materials and mitigates the negative interference cancellations in light materials, except for the pure photino or pure Higgsino cases where it does not contribute. In general, the rates can be substantially different from the pure photino and pure Higgsino special cases usually considered.

57722 **Expressions for linearized perturbations in ideal-fluid cosmological models.** Ratra, B. (Joseph Henry Laboratories, Department of Physics, Princeton University, Princeton, New Jersey 08544). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 8, 2399-2414(15 Oct 1988).

We present closed-form solutions of the relativistic linear perturbation equations (in synchronous gauge) that govern the evolution of inhomogeneities in homogeneous, spatially flat, ideal-fluid, cosmological models. These expressions, which are valid for irregularities on any scale, allow one to analytically interpolate between the known approximate solutions which are valid at early times and at late times.

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57723 **(AD-A—194792/8/XAB) Cross-correlation analysis and interpretation of spaced-receiver measurements.** Costa, E.; Fougere, P.F.; Basu, S. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). Apr 1988. 23p. (AFGL-TR—88-0115). NTIS, PC A03/MF A01.

Pub. in Radio Science, Vol. 23, No. 2, 141-162(Mar-Apr 1988).

Two algorithms that provide a statistical treatment to the estimation of the parameters of the cross-correlation analysis of spaced-receiver data are reviewed. Their results are compared using signals transmitted by a quasi-stationary polar beacon and received at Goose Bay, Labrador; and transmitted by the orbiting Hilat satellite and received at Tromso, Norway. A good general agreement is displayed in this comparison. The former experiment indicates the possibility of extreme daily variations in the anisotropy of the ground diffraction pattern and in the true drift velocity of the in-situ irregularities. The latter experiment displays geometrical enhancements in the intensity scintillation index S sub 4, in the rms phase fluctuation sigma/sub phi/ and in the axial ration of the ellipse which characterizes the anisotropy of the ground-diffraction pattern, around the region of local L shell alignment of the ray paths. Increases of these parameters also are observed northward of Tromso. These observations are thus consistent with a morphological model for anisotropy of high-latitude nighttime F-region irregularities proposed in the literature. A possible dependence of the results of the spaced-receiver measurements on the receiver baselines is discussed. It is argued that this mechanism could be responsible for the relatively small values of the anisotropy of the diffraction pattern obtained from the Hilat measurements at Tromso.

57724 **(AD-A—194793/6/XAB) Cross-spectral analysis of spaced-receiver measurements.** Costa, E.; Fougere, P.F. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). Apr 1988. 13p. (AFGL-TR—88-0117). NTIS, PC A03/MF A01.

Pub. in Radio Science, Vol. 23, No. 2, 129-139(Mar-Apr 1988).

The apparent velocity calculated by the dispersion analysis is interpreted in terms of the fundamental parameters of the cross-correlation analysis of spaced-receiver data, without any assumptions in addition to those already present in the latter technique. The dispersion analysis is then generalized, by assuming, a realistic (power law) functional form for the power spectral density of the irregularities in the ionospheric F region. Next, an algorithm is proposed to estimate the anisotropy and the true drift velocity of the ground-diffraction pattern directly from the cross spectra of the received signals. This technique is applied to HiLat spaced-receiver data recorded at Tromso, Norway, in two different modes. In the first, it is applied on a relatively broad frequency band and its results compared with those from the cross-correlation analysis. A good general agreement is found. In the second mode, the technique is repeatedly applied on narrow and adjacent frequency bands, to detect possible frequency variations of the anisotropy of the diffraction pattern. A behavior analogous to that of the apparent velocity, previously reported in the literature, is then observed.

57725 **(AD-A—194821/5/XAB) Radar observations of the onset of current-driven instabilities in the topside ionosphere.** Foster, J.C.; Pozo, C.; Groves, K. (Haystack Observatory, Westford, MA (USA)). Feb 1988. 6p. NTIS, PC A02/MF A01.

Pub. in Geophysical Research Letters, Vol. 15, No. 2, 160-163(Feb 1988).

Milestone Hill radar spectra exhibit pronounced spectral asymmetries in the presence of field-aligned currents in the topside ionosphere. The enhanced, often intense, returns associated with the current-driven growth of the ion-acoustic mode exhibit the characteristics of hard-target backscatter suggesting that many satellite echoes observed by UHF radars at high latitudes might be caused by this mechanism. A large current density (>100 microamp/sq.m) is calculated for the conditions observed, consistent with that seen in intense earthward-directed current filaments. These observations indicate that the ion-acoustic mode grows toward instability with increasing altitude. Backscatter observed from the unstable region at higher altitudes is characteristically at the ion plasma frequency consistent with the unstable growth of the acoustic mode for large ratios of electron-to-ion temperature.

57726 **(AD-A—195000/5/XAB) Local transverse ion energization in and near the polar cusp.** Andre, M.; Koskinen, H.; Matson, L.; ERlandson, R. (Massachusetts Inst. of Tech., Cambridge (USA)). Jan 1988. 5p. NTIS, PC A02/MF A01.

Pub. in Geophysical Research Letters, Vol. 15, No. 1, 107-110(Jan 1988).

Ion conics are often observed in the dayside polar-cusp region of the magnetosphere by the polar-orbiting Viking satellite. These ion distributions may be locally heated perpendicularly to the ambient magnetic field to temperatures of about 100 eV. The conics are closely associated with increased electron fluxes but may occur equatorward of the region of ions injected from the magnetosheath. They are also closely related to waves with frequencies up to about 100 Hz. The wave electric field is directed mainly perpendicular to the ambient magnetic field and shows no clear structure near the ion gyrofrequencies or their harmonics. Observations of ion conics at 90° pitch angle and the related waves indicate that the waves may cause significant ion heating, especially of heavy ions.

57727 **(AD-A—195335/5/XAB) Role of ordinary-to extraordinary mode wave coupling in ionospheric heating experiments. Final report, July 1983-August 1985.** Abali, B.; Seliga, T.A.; Aydin, K. (Ohio State Univ. Research Foundation, Columbus (USA)). Mar 1988. 147p. (AS-S—121). NTIS, PC A07/MF A01.

Availability: Document partially illegible.

Electromagnetic wave propagation in a plane stratified ionospheric plasma and its possible applications to high-power, high-frequency (HF) experiments are investigated. A theoretical and computational examination of ordinary- to extraordinary-mode wave coupling is made. This coupling occurs when the propagation is in the magnetic meridian, near the critical angle of incidence. The importance of the mode-coupling phenomenon in ionospheric heating experiments is discussed and demonstrated with numerical full wave solutions of the generalized differential equations governing radiowave propagation in a stratified ionosphere. Computational results indicate that mode coupling leads to intense absorption of radiowave energy near the plasma resonance level. The angular shape of the coupling window, in which the coupling is most effective, is found to be approximately circular with its width being a function of the gradient of the electron density.

57728 **(INIS-SU—45, pp 6-8) Energy spectrum of channels of cosmic ray extensive air showers.** Nikol'skij, S.I.; Chubenko, A.P. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780096/JAW.

Kratkie Soobshcheniya po Fizike.; (no.11).

In Plasma physics. Collection.

Energy spectrum of extensive atmospheric showers in the depth of atmosphere (690 g/cm/sup 3/) according to total energy of hadrons in channels has a "bent", which fully corresponds to the "bent" in the energy spectrum of primary cosmic radiation. 9 refs.; 2 figs.

57729 **On the origin of hot diamagnetic cavities near the Earth's bow shock.** Thomsen, M.F.; Gosling, J.T.; Bame, S.J.; Quest, K.B.; Russell, C.T.; Fuselier, S.A. (Los Alamos National Laboratory, Los Alamos, New Mexico). *Journal of Geophysical Research;* **93**: No. A10, 11311-11325(1 Oct 1988).

On occasion, hot diamagnetic cavities have been observed upstream from the, Earth's bow shock. The origin of these cavities has been a mystery ever since their discovery several years ago. In this paper, we note that, although only a small number of such events have so far been identified (corresponding to an average of about one event per month of observing time), for of these previously identified events occured on a single day (November 16, 1977). Additional plasma and field data from that day are examined in considerable detail for further clues to the possible source of these events. A remarkable characteristic of the interplanetary medium on November 16 was the presence throughout that day and the next of large-amplitude, very low-frequency, nonmonochromatic, and noncompressive magnetic field variations (i.e., rotations), which resulted in intermittent magnetic connections between the observing spacecraft and the bow shock. The previously identified hot diamagnetic cavity events (HDCs), as well as several other intervals of HDC-like properties observed very near the shock itself, tend to occur near transitions between quasi-perpendicular and quasi-parallel shock geometries. Furthermore, several of the HDC-like episodes seen near and within the shock are closely associated with intervals of dense, nearly specularly reflected ions.

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REFER ALSO TO CITATION(S) 56088, 56089, 57112, 57113, 57114, 57206, 57911, 57922, 58041, 58048, 58175

57730 (AD-A—195211/8/XAB) Negative-ion formation in lithium-atom collisions. Michels, H.H.; Montgomery, J.A. (United Technologies Research Center, East Hartford, CT (USA)). 1986. 11p. (UTRC—927258-4). NTIS, PC A03/MF A01.

Pub. in Proceedings of the International Symposium on the Production and Neutralizations of Negatives Ions and Beams(1986).

The formation of Li^- by dissociative attachment in $e + Li_2$ collisions is characterized by a large cross section for electron attachment to highly vibrationally excited Li_2 molecules. However, the electronic structure of the Li_2 system dictates that low-energy electrons (< or = 2 eV) are needed to minimize loss processes. An alternate production route for Li^- is possible via direct ion-pair formation through collisions of highly excited (Rydberg) Li atoms. The mechanisms for ion-pair formation is discussed in terms of the high-lying molecular Rydberg states of Li_2.

57731 (CONF-880955—1) State-selective electron capture. Dunford, R.W.; Liu, C.J.; Berry, H.G.; Pardo, R.C.; Raphaelian, M.L.A. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 4p. NTIS, PC A02/MF A01. Order Number DE89000518/JAW.

From International conference on the physics of multiply-charged ions; Grenoble, France (12 Sep 1988).

We report results from a new atomic physics program using the Argonne PII ECR ion source which is being built as part of the upgrade of the Argonne Tandem-Linear Accelerator (ATLAS). Our initial experiments have been aimed at studying state-selective electron capture in ion-atom collisions using the technique of Photon Emission Spectroscopy. We are extending existing cross section measurements at low energy (<15 keV/amu) to higher energy taking advantage of the fact that the Argonne source is on a 350-kV high-voltage platform. Experiments have included measurements of capture cross sections for O^{6+} and O^{7+} on He and H_2 targets in the energy range from 1-105 keV/amu. We also present uv spectra obtained in collisions of O^{6+}, O^{5+} and N^{5+} on a sodium target. 4 refs., 2 figs., 1 tab.

57732 (CONF-880955—3) Electron capture by multicharged ions at eV energies. Havener, C.C.; Huq, M.S.; Meyer, F.W.; Phaneuf, R.A. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 17p. NTIS, PC A03/MF A01. Order Number DE89001156/JAW.

From International conference on the physics of multiply-charged ions; Grenoble, France (12 Sep 1988).

A multicharged ion-atom merged-beams apparatus has been used in conjunction with the ORNL-ECR ion source to measure accurate absolute electron-capture cross sections in the energy range from below 1 eV/amu to 1500 eV/amu. Measurements for N/sup 3+,4+,5+/ {plus} H(D) collisions indicate good agreement with available theoretical calculations. However, measurements with O^{5+} {plus} H(D) show an unexpected low-energy behavior which may be attributable to the ion-induced-dipole attraction between the reactants. Scaled Landau-Zener calculations presented here identify a transfer plus excitation channel which has the correct energy dependence at low energies. This finding suggest the need for a comprehensive coupled channel calculation which would include such product states. 25 refs., 8 figs.

57733 (CONF-881002—2) Influence of the ac Stark effect on stimulated hyper-Raman profiles in sodium vapor. Moore, M.A.; Garrett, W.R.; Payne, M.G. (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01. Order Number DE88015557/JAW.

From 35. national vacuum symposium and 4th international laser science conference; Atlanta, GA, USA (2 Oct 1988).

When pumping near the two-photon 3d resonance in pure sodium vapor and observing the backward hyper-Raman emission to the 3p substates, an asymmetry in ratios of 3p/sub 1/2/, 3p/sub 3/2/ associated emissions was observed dependent upon the direction of the initial laser detuning from the resonance. It has been determined that this asymmetry can be attributed to the ac Stark effect induced by the hyper-Raman emission itself. 3 refs., 3 figs.

57734 (CONF-881151—14) Differential charge state fractions of He following ionization by fast H/sup {minus}/ projectiles. Giese, J.P.; Horsdal, E. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 12p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89001205/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

The differential charge state fractions of He ions produced in ionization by fast H/sup {minus}/ projectiles have been measured at projectile scattering angles between 0.25 and 1.59 mrad and an impact energy of 1.0 MeV. These charge state fractions have been measured for each of the possible final charge states of the H/sup {minus}/ projectile (H/sup {minus}/, H, and p^+). Combined with earlier measurements of simple ionization (no change in projectile charge state) by protons and of capture and ionization by protons, some systematics cam be noted. The fraction of doubly charged He ions exhibits a distinct peak between 0.9 and 1.1 mrad for simple ionization. A similar peak is seen at ~0.55 mrad for ionization accompanied by either capture by protons or by single stripping of H/sup {minus}/. The data for proton impact suggest that all the peaks are related to double ionization of the target. The double ionization mechanisms will be discussed in terms of their possible contribution to the observed structures. 13 refs., 3 figs.

57735 (CONF-8704112—, pp 361-371) Applications of ^{129}I and ^{36}Cl in hydrology. Fabryka-Martin, J.; Davis, S.N.; Elmore, D. (Univ. of Arizona, Tucson (USA)). 1987. Elsevier Science Publishers Co. Inc., 52 Vanderbilt Ave., New York 10017. Order Number TI88013520/JAW.

From 4. international symposium on accelerator mass spectrometry; Ontario, Canada (27 Apr 1987).

Since the first AMS measurements of ^{36}Cl in 1978, this cosmogenic radionuclide has proved to be a versatile tracer of hydrologic processes in over 20 field studies. Natural ^{129}I also appears to be useful for studying hydrologic processes although incomplete understanding of its production in nature and geochemical behavior largely limits interpretation to qualitative discussions. The range of hydrologic applications demonstrated for these radionuclides covers: estimation of residence time of water in the subsurface and net infiltration in arid soils; evaluation of ion filtration, leaching of connate water, and salt dissolution as sources of ground-water salinity; estimation of lithospheric thermal-neutron fluxes; and emanation and migration characteristics of fission-product ^{129}I in different geochemical environments.

57736 (CONF-8704112—, pp 372-375) ^{36}Cl: a tracer in ground water in the Aquia formation of southern Maryland. Purdy, C.B.; Mignerey, A.C.; Helz, G.R.; Drummond, D.D.; Kubik, P.W.; Elmore, D.; Hemmick, T. (Univ. of Maryland, College Park (USA)). 1987. Elsevier Science Publishers Co. Inc., 52 Vanderbilt Ave., New York 10017. Order Number TI88013520/JAW.

From 4. international symposium on accelerator mass spectrometry; Ontario, Canada (27 Apr 1987).

The Aquia Formation (Paleocene) of Southern Maryland, a marine unit consisting predominantly of quartz sands, but containing 20-40% glauconite, represents one of the many productive, heavily pumped aquifers of the Southeastern Coastal Plain. An unusually high ^{36}Cl activity (~ 15 x modern water) measured in an outcrop sample is interpreted as a result of the bomb pulse input. About 25 km downdip from the recharge area, a minimum in total chloride concentration occurs. This minimum is thought to correlate with the latest low-stand of sea-level, and thus to provide time information which is in general agreement with ages calculated from hydrodynamic data. However, significant increases in the ^{36}Cl concentrations are observed along the flow path which may be due to ion filtration or to leakage of modern, bomb-contaminated water into the Aquia aquifer.

57737 (CONF-8704112—, pp 376-379) **Infiltration at Yucca Mountain, Nevada, traced by ^{36}Cl.** Norris, A.E.; Wolfsberg, K.; Gifford, S.K.; Bentley, H.W.; Elmore, D. (Los Alamos National Lab., NM (USA)). 1987. Elsevier Science Publishers Co. Inc., 52 Vanderbilt Ave., New York 10017. Order Number TI88013520/JAW.

From 4. international symposium on accelerator mass spectrometry; Ontario, Canada (27 Apr 1987).

Measurements of chloride and ^{36}Cl in soils from two locations near Yucca Mountain, Nevada, have been used to trace the infiltration of precipitation in this arid region. The results show that the ^{36}Cl fallout from nuclear-weapons testing formed a well-defined peak at one location, with a maximum ^{36}Cl/Cl ratio 0.5 m below the surface. The structure of the ^{36}Cl bomb pulse at the other location was much more complex, and the quantity of ^{36}Cl in the bomb pulse was $< 1\%$ of the 6×10^{12} atoms ^{36}Cl/m^2 in the bomb pulse at the first location. The data indicate hydrologic activity subsequent to the ^{36}Cl bomb-pulse fallout at one location, but none at the other location.

57738 (CONF-8704112—, pp 389-392) **Search for anomalously heavy isotopes of low Z nuclei.** Hemmick, T.K.; Elmore, D.; Kubik, P.W.; Olsen, S.L.; Gentile, T.; Nitz, D.; Ciampa, D.; Kagan, H.; Haas, P.; Smith, P.F.; McInteer, B.B. (Univ. of Rochester, NY (USA)). 1987. Elsevier Science Publishers Co. Inc., 52 Vanderbilt Ave., New York 10017. Order Number TI88013520/JAW.

From 4. international symposium on accelerator mass spectrometry; Ontario, Canada (27 Apr 1987).

The authors present the results of a search for anomalously heavy isotopes of light elements using an electrostatic charged particle spectrometer in conjunction with the MP tandem accelerator facility at the Nuclear Structure Research Laboratory of the University of Rochester. New limits for the abundance of anomalously heavy isotopes (100-10,000 amu) in ordinary terrestrial H, Li, Be, B, and F samples and enriched ^{2}H, ^{13}C, and ^{18}O samples are reported.

57739 (CONF-8704112—, pp 398-406) **Resonance ionization spectroscopy and the detection of ^{81}Kr.** Thonnard, N.; Willis, R.D.; Wright, M.C.; Davis, W.A.; Lehmann, B.E. (Atom Sciences, Inc., Oak Ridge, TN (USA)). 1987. Elsevier Science Publishers Co. Inc., 52 Vanderbilt Ave., New York 10017. Order Number TI88013520/JAW.

From 4. international symposium on accelerator mass spectrometry; Ontario, Canada (27 Apr 1987).

Development of resonance ionization spectroscopy (RIS) has made the concept of single-atom counting, whether radioactive or stable, practical for most elements of the periodic table. Tunable narrow-band lasers are used to efficiently and selectively excite and ionize a chosen element without interference from the much more abundant background, thereby achieving sensitivity at the level of a few atoms. Applications of the selectivity and sensitivity of RIS are numerous, including the direct analysis of solid, chemically processed liquid and noble gas samples. For example, ^{81}Kr, a 2.1×10^5 year half-life cosmogenic radioisotope was detected with less than 400 ^{81}Kr atoms in the RIS analysis system.

57740 (CONF-8704112—, pp 407-414) **Photon burst mass spectrometry.** Fairbank, W.M. Jr. (Colorado State Univ., Fort Collins (USA)). 1987. Elsevier Science Publishers Co. Inc., 52 Vanderbilt Ave., New York 10017. Order Number TI88013520/JAW.

From 4. international symposium on accelerator mass spectrometry; Ontario, Canada (27 Apr 1987).

A photo burst atom counter, with high isobaric and isotopic selectivity, could be used to eliminate interferences which limit sensitivity in mass spectrometers. With the addition of such a device, a conventional mass spectrometer of moderate capability should be capable of measuring isotope ratios at the 10^{-15} level. A photo burst detector could also open up the heavy elements to smaller AMS machines. About half the elements of the periodic table could be studied by Photon Burst Mass Spectrometry.

57741 (CONF-8704112—, pp 415-423) **Perspectives in radiocarbon dating by radiometry.** Polach, H.A. (Australian National Univ., Canberra). 1987. Elsevier Science Publishers Co. Inc., 52 Vanderbilt Ave., New York 10017. Order Number TI88013520/JAW.

From 4. international symposium on accelerator mass spectrometry; Ontario, Canada (27 Apr 1987).

Opportunities for individual contributions to the technology of radiocarbon dating over the past 40 years have been large. Meaningful developments are traced in this review of C-14 dating by gas proportional (GP) and liquid scintillation (LS) spectrometry. The performance of characteristic as well as state of the art GP and LS systems is tabulated and their merit for low-level counting of C-14 is evaluated. Future developments in radiometry will lie in the updating of existing systems to incorporate new technologies and the refinement of resolution and identification of extreme low-level signals. Parallel development with AMS, sharing on merit the ever widening applied C-14 research field, and enhanced interdisciplinary collaboration are foreseen as the scenario leading to the year 2000.

57742 (CONF-8704112—, pp 424-426) **Decay counting in the age of AMS.** Arnold, J.R. (Univ. of California, San Diego, La Jolla (USA)). 1987. Elsevier Science Publishers Co. Inc., 52 Vanderbilt Ave., New York 10017. Order Number TI88013520/JAW.

From 4. international symposium on accelerator mass spectrometry; Ontario, Canada (27 Apr 1987).

Up to the advent of AMS, all the accomplishments of ^{14}C dating, and the studies of ^{10}Be and other long-lived radionuclides, were made by low-level decay counting, the technique pioneered by W.F. Libby. It will hardly be news to people at this conference that, while much was accomplished in the three decades when counting prevailed, the world has now changed decisively. He will try to give an account of where low-level counting was before the revolution, and of what its usefulness is today. There are still some remarkable examples of its application, the best being the neutrino experiment of Raymond Davis, and its potential successors. Some cosmogenic nuclides, whose half-lives are less than 10^3 yr, are still best measured by decay; this will continue unless the overall ion yield of AMS systems rises markedly from present levels. One long-lived nuclide, ^{53}Mn, is still best measured by neutron activation as 312-day ^{54}Mn, but this may not continue.

57743 (CONF-8704112—, pp 427-436) **Tandem mass spectrometry at low kinetic energy.** Cooks, R.G.; Hand, O.W. (Purdue Univ., West Lafayette, IN (USA)). 1987. Elsevier Science Publishers Co. Inc., 52 Vanderbilt Ave., New York 10017. Order Number TI88013520/JAW.

From 4. international symposium on accelerator mass spectrometry; Ontario, Canada (27 Apr 1987).

Recent progress in mass spectrometry, as applied to molecular analysis, is reviewed with emphasis on tandem mass spectrometry. Tandem instruments use multiple analyzers (sector magnets, quadrupole mass filters and time-of-flight devices) to select particular molecules in ionic form, react them in the gas-phase and then record the mass, momenta or kinetic energies of their products. The capabilities of tandem mass spectrometry for identification of individual molecules or particular classes of compounds in complex mixtures are illustrated. Several different types of experiments can be run using a tandem mass spectrometer; all share the feature of sifting the molecular mixture being analyzed on the basis of chemical properties expressed in terms of ionic mass, kinetic energy or charge state. Applications of mass spectrometry to biological problems often depend upon desorption methods of ionization in which samples are bombarded with particle beams. Evaporation of preformed charged species from the condensed phase into the vacuum is a particularly effective method of ionization. It is suggested that the use of accelerator mass spectrometers be extended to include problems of molecular analysis. In such experiments, low energy tandem mass spectrometry conducted in the eV or keV range of energies, would be followed by further characterization of the production ion beam using high selective MeV collision processes.

57744 **(CONF-8808122—2) Postron ionization mass spectrometry.** Donohue, D.L.; Glish, G.L.; McLuckey, S.A.; Hulett, L.D. Jr.; McKown, H.S.; Pendyala, S. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 3p. NTIS, PC A02. Order Number DE88016816/JAW.

From 8. international conference on positron annihilation; Gent, Belgium (29 Aug 1988).

Experiments are in progress to study the ionization of large molecules by slow positrons. Low energy positrons are being impinged on molecules such as butane, ethanol, benzene, toluene, and others. Masses of the resulting ions are being measured to study the fragmentation that follows the ionization processes. Studies will be made to determine if certain molecules or molecular groups can be selectively ionized by positron attachment. Results of this work are expected to lead to improved methods in analytical mass spectrometry. 4 refs., 3 figs.

57745 **(DOE/ER/13421—7) An experimental investigation of Hanle resonances using a phase diffusing laser field with variable parameters.** Smith, S.J.; Arnett, K. (Colorado Univ., Boulder (USA); National Bureau of Standards, Boulder, CO (USA)). 1988. Contract FG02-85ER13421. 10p. (CONF-8809135—1). NTIS, PC A02/MF A01. Order Number DE88016838/JAW.

From 13. international conference on coherent and nonlinear optics; Minsk, USSR (6 Sep 1988).

In this paper we describe an experimental investigation of a zero- field level crossing resonance in the observed fluorescence at 555.6 nm resulting from excitation of the $^1S/sub O/ \rightarrow {}^3P_1$ transition in transition in Yb^{174} by a linearly polarized laser field. The essential new feature of this investigation is the use of an optical field for which the phase coherence is well-characterized and variable over a wide range. We have developed, and apply here, experimental techniques for synthesizing constant amplitude laser fields with phase/frequency fluctuations which follow Gaussian (normal) statistics and which have spectral dependences which can be varied over a range from nearly Lorentzian to nearly Gaussian profiles. These synthesized fields correspond, to a good approximation, to the so-called phase-diffusion fields described in theoretical studies of the ac Stark effect with Lorentzian and non-Lorentzian laser line shapes, and have been applied previously in several related experimental investigations. 13 refs., 6 figs., 1 tab.

57746 **(DOE/ER/45190—T3) Fundamental properties of spin-polarized quantum systems: Technical progress report.** Silvera, I.F. (Harvard Univ., Cambridge, MA (USA). Dept. of Physics). [1988]. Contract FG02-85ER45190. 3p. NTIS, PC A02/MF A01. Order Number DE89002064/JAW.

This paper briefly discusses: stability of spin polarized hydrogen in ultra-high fields; microwave trapping of atomic hydrogen; hydrogen masers; third sound as hydrogen surfaces; and crossed beam scattering of spin polarized hydrogen. (LSP)

57747 (INIS-BR—1229, pp 14) **Two types of MEV ion beam enhanced adhesion for Au Films on SiO/sub 2/.** Wie, C.R.; Mendenhall, M.H.; Tombrello, T.A.; Shi, C.R.; Vreeland, T.; Livi, R.P. (California Inst. of Tech., Pasadena (USA); Lanzhou Univ., GS (China); Rio Grande do Sul Univ., Porto Alegre (Brazil)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57748 (INIS-BR—1229, pp 15) **Adhesion enhancement induced by MEV ion beams.** Livi, R.P. (California Inst. of Tech., Pasadena (USA)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57749 (INIS-BR—1229, pp 17) **Electrical contact and adhesion modification produced by high energy heavy ion bombardment of Au film on GaAs.** Livi, R.P.; Paine, S.; Wite, C.R.; Mendenhall, M.H.; Tang, J.Y.; Vreeland Junior, T.; Tombrello, T.A. (California Inst. of Tech., Pasadena (USA)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57750 (INIS-SU—45, pp 26-28) **Effect of anisotropy of triplet exciton diffusion on the kinetics of α-oscillations in anthracene.** Averyushkin, A.S.; Vitukhnovskij, A.G.; Zhevandrov, N.D.; Pitel', B.L.; Sluch, M.I. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780096/JAW.

Kratkie Soobshcheniya po Fizike.; (no.11).

In Plasma physics. Collection.

Kinetics of annihilation slowed down fluorescence in anthracene monocrystals is measured experimentally in the process of its excitation by α-particles along crystal different axes and is calculated by the Monte Carlo method using a computer and taking into account quantum-chemical data. Comparison permitted to make conclusions on quasitwo-dimensional character of triplet exciton diffusion. 11 refs.; 1 fig.

57751 **(LA-UR—88-3084) Search for x rays generated by collisionless multiphoton processes.** Lee, P.H.Y.; Casperson, D.E.; Schappert, G.T. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 15p. (CONF-880904—2). NTIS, PC A03/MF A01. Order Number DE89000350/JAW.

From 4. topical meeting on short wavelength coherent radiation: generation and applications; Cape Cod, MA, USA (26 Sep 1988).

We have conducted photon counting experiments to search for x rays which may be generated by either collisionless multiphoton induced inner-shell processes or bremsstrahlung at high laser irradiance. Using KrF light at an irradiance {approximately}3 x 10^{17} W/cm^2 on low density Xe gas targets, we detect no prompt photons which are characteristic of these processes. 7 refs., 3 figs.

57752 **(UCID—20973) Tensor averages in molecular Raman processes.** Shore, B.W.; Sacks, R. (Lawrence Livermore National Lab., CA (USA)). 15 Jan 1987. Contract W-7405-ENG-48. 40p. NTIS, PC A03/MF A01. Order Number DE89001466/JAW.

Molecular Raman processes are a particular case of two-photon transitions involving absorption of one photon and emission of a different photon, accompanied by a Raman transition in an irradiated molecule. The vector nature of the electromagnetic field introduces (operator) tensors as measures of the interaction strength. For electric-dipole transitions, considered here, the tensors are second rank. Both the field and the molecule are represented by second-rank tensors, combined to produce a scalar interaction. Invariably the molecule has orientation degeneracy, as expressed by the magnetic quantum number M. Observed quantities must average over orientations of the molecule, and of the molecule-fixed tensors. The averages affect such observables as the angular distribution of scattered radiation having specified polarization. This memo discusses applications of angular momentum theory to the evaluation of those averages. 51 refs.

57753 **(UCRL—21028) Study of extreme ultraviolet laser sources for the guiding of particle beams.** Rhodes, C.K. (Illinois Univ., Chicago (USA). Dept. of Physics). 31 Jul 1987. Contract W-7405-ENG-48. 111p. NTIS, PC A06/MF A01. Order Number DE88008918/JAW.

Spectrally bright femtosecond sources of short wavelength radiation can be applied to guide particle beams and possibly enable the collective acceleration of electrons. An effort directed at the development of extremely high peak power ultraviolet sources in the range of {approximately}10 TW is proposed. 158 refs.

57754 **(UCRL—98775) Photoexcitation and cooling of positronium.** Dermer, C.D.; Howell, R.H.; Jones, K.M.; Liang, E.P.; Magnotta, F.; Ziock, K.P. (Lawrence Livermore National Lab., CA (USA)). Aug 1988. Contract W-7405-ENG-48. 5p. (CONF-8808122—6). NTIS, PC A02/MF A01. Order Number DE88017025/JAW.

From 8. international conference on positron annihilation; Gent, Belgium (29 Aug 1988).

Our demonstration of multiple-photon resonant cycling between the 1^3S and 2^3P states of ortho-Positronium (oPs) makes possible the production of cold positronium (Ps) through the technique of laser cooling. A simplified analysis of magnetic mixing in excited-state Ps is given. This effect is important both as a diagnostic of resonant cycling and Ps cooling. The significance of cold Ps in fine structure measurements and the formation of a Bose-Einstein condensate is discussed. 13 refs., 3 figs.

57755 **(UCRL—99685) Initial results on the formation of an Xenon ion channel in the recharging E/sub z/ at ATA.** Lauer, E.J.; Chambers, F.W.; Chong, Y.P.; Fawley, W.M.; Lee, P.; Orzechowski, T.J.; Struve, K.W.; Weir, J.T. (Lawrence Livermore National Lab., CA (USA)). 28 Sep 1988. Contract W-7405-ENG-48. 11p. (CONF-8809149—5). NTIS, PC A03. Order Number DE89001041/JAW.

From DARPA/SDIO services annual propagation review; Newport, RI, USA (12 Sep 1988).

The observations of relativistic electron beam focusing and guiding in the ion channel formed in benzene gas at ATA suggest that it might be advantageous to use a heavier ion mass. In principle Xe could be ionized by shifting the frequency of the KrF laser, and tests for this purpose have been proposed by W.K. Bischel and D.J. Eckstrom at SRI. Here we report on initial tests of a different scheme for producing an Xe ion channel in ATA. During about 20 μ s just before the main forward pulse, there is a relatively small gap voltage due to the recharging of the Blumlein capacity. A mixture of gases consisting of about a micron of Xe and a small fraction of benzene is used. The laser is fired a few hundred ns before the main foreward accelerator voltage pulse and produces a small initial benzene plasma density. The electrons avalanche in the recharging E/sub z/ and build up a plasma column which has mainly Xe ions. 6 figs., 2 tabs.

57756 **Radiation from oscillating dipoles embedded in a layered system.** Crawford, O.H. (Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6123). *Journal of Chemical Physics;* **89**: No. 10, 6017-6027(15 Nov 1988).

Maxwell's equations are solved for the radiation due to a source consisting of an oscillating point dipole located in a layered system. Solutions are developed first for the related problem of the fields generated in the system by a distant dipole source, and the problem of interest is then solved by application of the Lorentz reciprocity theorem. The effects of extremely thin layers are considered in detail. Some of the results are illustrated by calculations of the emission from dipoles located in, or near, a film covering a plane-bounded silver metal substrate. It is found that the surface selection rule for absorption, emission, or Raman scattering is not valid for molecules contained in this film.

57757 **Observation of correlation effects in zero kinetic energy electron spectra near the N1s and C1s thresholds in N_2, CO, C_6H_6, and C_2H_4.** Medhurst, L.J.; Ferrett, T.A.; Heimann, P.A.; Lindle, D.W.; Liu, S.H.; Shirley, D.A. (Department of Chemistry, University of California and Materials and Chemicals Sciences Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Journal of Chemical Physics;* **89**: No. 10, 6096-6102(15 Nov 1988).

Zero kinetic energy (ZKE) spectra of N_2, CO, C_2H_4, and C_6H_6 were taken across the N1s (N_2) and C1s ionization thresholds. Discrete resonances at subthreshold photon energies were observed and were found to become more intense as threshold is approached relative to the same peaks in absorption spectra. For N_2 the satellite/main line branching ratios at threshold are: 11(1)% for the 419.7(1) eV binding energy satellite, and 2.3(1.0)% for the 426.5(1) eV binding energy satellite. For CO, the branching ratio for the 304.6(1) eV binding energy satellite is 15(2)% at its threshold. Branching ratios at threshold are also determined for the satellites of C_6H_6 and C_2H_4. Decay characteristics and assignments of the continuum features of C_6H_6 and C_2H_4 are also discussed.

57758 **Spectroscopic properties of 41 electronic states of Pd_2.** Balasubramanian, K. (Department of Chemistry, Arizona State University, Tempe, Arizona 85287-1604). *Journal of Chemical Physics;* **89**: No. 10, 6310-6315(15 Nov 1988).

Complete active space MCSCF (CASSCF) followed by multireference singles+doubles CI (MRSDCI) and relativistic configuration interaction (RCI) calculations are carried out on electronic states of Pd_2. Forty-one electronic states are found below the 8000—9000 cm^{-1} region and their spectroscopic properties are calculated. The dissociation energy of the lowest state with respect to the ^3D atoms is calculated to be 2.1 eV. Relativistic and spin—orbit effects are found to be significant for the electronic states of Pd_2.

57759 **Calculation of excited state properties with quantum Monte Carlo.** Ceperley, D.M.; Bernu, B. (National Center for Supercomputing Applications and Department of Physics, University of Illinois, Champaign, Illinois 61820). *Journal of Chemical Physics;* **89**: No. 10, 6316-6328(15 Nov 1988).

A new Monte Carlo method for computing excited state properties of quantum systems is introduced. It is a generalization of the transient estimate method used for fermion Green's function Monte Carlo and of subspace projection methods used for computing eigenstates of matrices. The time dependent autocorrelation function of a vector of trial functions is calculated for a random walk generated by the imaginary-time Schroedinger equation and estimates of energy levels are determined by the eigenvalues of the matrix of correlation functions. This method is especially useful for treating states with the same symmetry as it automatically keeps higher states orthogonal to lower states. The estimated energy converges to the exact eigenvalue with a rate which decreases with increasing excitation energy, thus limiting the method to relatively low-lying states. The method is zero variance in the sense that as better trial functions are introduced, the statistical error decreases to zero. The method has a nontrivial bias which is analyzed. As an illustration, the eigenvalues of a double well are computed.

57760 **Electron degradation and yields of initial products. III. Dissociative attachment in carbon dioxide.** Pagnamenta, A.; Kimura, M.; Inokuti, M.; Kowari, K. (Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Chemical Physics;* **89**: No. 10, 6220-6225(15 Nov 1988).

We demonstrate the importance of subexcitation electrons in CO_2 (with energies below 6 eV) by studying the yield of negative-ion formation in the dissociative attachment process $e^- + CO_2 \rightarrow CO + O^-$. We evaluate the electron degradation spectrum and the time dependence of the degradation process within the continuous-slowing-down approximation. Slowing down by vibrational and other excitation collisions and the O^- production are competing processes. This explains why the O^- yield is larger for subexcitation electrons with energies above 3.8 eV, which avoid the large energy loss by electronic excitation and can still pass through the resonance at about 4 eV. The attachment at 8 eV with a much larger resonance-like cross section contributes only about 30% to the total O^- yield in the degradation process.

57761 **Precision isotope shifts for the heavy elements. IV. Theoretical interpretation of the shifts in the low even configurations of Th I and Th II.** Blaise, J.; Wyart, J.; Engleman R. Jr.; Palmer, B.A. (Laboratoire Aime Cotton, Centre National de la Recherche Scientifique, Batiment 505, Centre Universitaire, 91045 Orsay, France). *Journal of the Optical Society of America B: Optical Physics;* **5**: No. 10, 2087-2092(Oct 1988).

The low even levels of Th I and Th II are interpreted by using the Slater—Condon parametric method and by taking into account recent results obtained by using Fourier-transform spectrometry. Several levels of $6d^4$, starting with $^5D_0$ at 21 176.01 cm/sup -1/ , are identified in Th I. The eigenfunctions in intermediate coupling are applied to the phenomenological interpretation of the isotope shifts in both spectra.

57762 **Revisions and additions to the energy levels of neutral curium (/sup 244/Cm I).** Blaise, J.; Worden, E.F.; Conway, J.G. (Laboratoire Aime Cotton, Centre National de la Recherche Scientifique, 91405 Orsay, France). *Journal of the Optical Society of America B: Optical Physics;* **5**: No. 10, 2093-2105(Oct 1988).

New spectroscopic data obtained using isotopically different samples have led to revisions and additions to the energy levels of neutral curium, /sup 244/Cm I. There are now 491 odd and 432 even energy levels with J values. Almost all the levels have isotope shift, and many have g values and configuration designations. Ten odd configurations and nine (one tentative) even configurations have been identified.

57763 **Accurate energy levels for singly ionized platinum (Pt II).** Reader, J.; Acquista, N.; Sansonetti, C.J.; Engleman R. Jr. (National Institute of Standards and Technology, Gaithersburg, Maryland 20899). *Journal of the Optical Society of America B: Optical Physics;* **5**: No. 10, 2106-2118(Oct 1988).

New observations of the spectrum of Pt II have been made with hollow-cathode lamps. The region from 1032 to 4101 A was observed photographically with a 10.7-m normal-incidence spectrograph. The region from 2245 to 5223 A was observed with a Fourier-transform spectrometer. Wavelength measurements were made for 558 lines. The uncertainties vary from 0.0005 to 0.004 A. From these measurements and three parity-forbidden transitions in the infrared, accurate values were determined for 28 even and 72 odd energy levels of Pt II.

57764 **Aluminumlike spectra of copper through molybdenum.** Sugar, J.; Kaufman, V.; Rowan, W.L. (Atomic and Plasma Radiation Division, National Institute of Standards and Technology, Gaithersburg, Maryland 20899). *Journal of the Optical Society of America B: Optical Physics;* **5**: No. 10, 2183-2189(Oct 1988).

Spectra of copper through molybdenum were generated in a tokamak plasma and were photographed with a 2.2-m grazing-incidence spectrograph. The doublet system of the Al I isoelectronic sequence was derived from these data and compared with Dirac—Fock calculations of the wavelengths. The smooth variation of the differences was used to improve the wavelengths and to predict those of rubidium and strontium, which were not observed.

57765 **Relativistic and correlation effects in the 2s3p configuration of berylliumlike ions.** Kim, Y.; Martin, W.C.; Weiss, A.W. (National Bureau of Standards, Gaithersburg, Maryland 20899). *Journal of the Optical Society of America B: Optical Physics;* **5**: No. 10, 2215-2224(Oct 1988).

Relativistic and correlation effects cause several inversions of the triplet and singlet J = 1 levels in the 2s3p configuration of berylliumlike ions. We have studied these effects in the range of atomic number Z = 6—54 by using both relativistic and nonrelativistic multiconfiguration wave functions. Theoretical predictions of energies of these levels with respect to the $2s^2\ ^1S_0$ ground level are compared with experimental data, and we conclude that overall the predictions for the ions having Z≅15 are probably more accurate than the available measurements. Calculated oscillator strengths for these resonance transitions are also reported. Near cadmium (Z = 48), we confirm still another inversion that is due to the complete dominance of relativistic effects, which was reported previously. The 2p3s $(1/2,1/2)_1$ level, a doubly excited state, goes below the 2s3p $(1/2,3/2)_1$ level, owing to relativistic hydrogenic ordering. This type of level crossing due to hydrogenic ordering is anticipated in other sequences as well, contrary to our usual experience in atomic spectroscopy.

57766 **Studies of the hyperfine enhanced nuclear antiferromagnet $Cs_2NaHoCl_6$.** Suzuki, H.; Masuda, Y.; Arthur, J. (Tohoku Univ., Sendai (Japan)). *Journal of Low Temperature Physics;* **70**: No. 3-4, 301-308(Feb 1988). Contract AC05-84OR21400.

A neutron scattering study of the hyperfine enhanced nuclear spin system $Cs_2NaHoCl_6$ has been carried out following adiabatic demagnetization cooling. The nuclear spin system was cooled to about 2 mK, below T/sub N/ = 4.8 mK. We did not observe any antiferromagnetic diffraction peaks in the (110) reciprocal lattice plane. The anisotropy of the magnetic susceptibility above and below the Neel temperature was also measured. The magnetic structure is discussed.

57767 **Investigations of the role of ponderomotive forces in ATI using subpicosecond laser pulses.** Freeman, R.R.; Bucksbaum, P.H.; Milchberg, H. (AT & T Bell Labs., Murray Hill, NJ (USA)). pp 2-11 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press, (1988). (CONF-870789—).

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The role of the ponderomotive force in Above Threshold Ionization (ATI) is explored using variable length pulses of 616 nm light ranging from 15 to 0.4 psec. These pulsewidths span the long-pulse to the short pulse regime for ATI. Experimental results show that the ATI peaks broaden and shift with decreasing pulsewidth, and that for the shortest pulsewidth, the individual ATI peaks break up into a series of fine structure peaks with instrument-limited widths. The authors analyze their data using a time-dependent ponderomotive potential and show that ponderomotive forces can account in detail for the observed shifts and broadening. The fine structure is shown to be the result of resonant enhancements of the ionization probability due to ponderomotive shifts of the levels of the xenon atom. They conclude by arguing that in the limit of very short pulse duration, the electron energy spectrum records the actual energies and angular distribution of the photoelectrons at the moment of ionization. Thus the use of ultra-short pulse excitation in high intensity multiphoton ionization experiments provides a means of obtaining spectroscopic data on target atomic or molecular species with the masking effects of final state (ponderomotive) scattering.

57768 **Electron energy spectra in high intensity multiphoton ionization.** Petite, G.; Agostini, P. (CEN Saclay, Gif-sur-Yvette (France)). pp 12-24 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

Application of Electron Energy Spectroscopy (EES) to multiphoton ionization in intense ($< 10^{13}$ W.cm^{-2}) laser fields is discussed. Examples are given of the kind of new information brought by these techniques. The specific problem of ATI in the high intensity limit and its relations with the question of the ponderometive potentials are then discussed, with help of recent experimental data on the effect of the laser pulse duration on the ATI spectrum. It is shown that long pulse experiments measure the total electron energy whereas short pulse (0.1 ps) experiments measure the electron drift energy inside the laser field.

57769 **Limiting cases of excess-photon ionization.** van Linden van den Heuvell, H.B.; Muller, H.G. (FOM-Institute for Atomic and Molecular Physics, Amsterdam (Netherlands)). pp 25-34 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

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Several experiments are discussed, all having in common that they can be interpreted as limiting or extreme cases of excess-photon ionization, and all performed with the purpose of studying one isolated aspect of EPI. The effect of intermediate resonances can be varied by scanning over a Rydberg series with a light pulse of tunable frequency and rather short duration. In addition, EPI performed with much shorter light pulses allows the observation of photoelectron spectra that are not affected by ponderomotive energy shifts.

57770 **Above threshold ionization of atomic hydrogen angular distribution of photoelectrons.** Feldman, D.; Wolff, B.; Wemhoener, M.; Welge, K.H. (Universitaet Bielefeld (West Germany)). pp 35-42 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

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The interaction of hydrogen atoms with an intense radiation field is a simple test case to study fundamental aspects of multipho-

ton ionization (MPI) and above threshold ionization (ATI) without interference from multi-electron effects. Results are reported of experiments in which the off-resonant wavelengths 355 nm and 532 nm where used to ionize H-atoms with minimum numbers of four and six absorbed photons necessary to overcome the field-free ionization potential of hydrogen. The electrons were detected energy- and angle-resolved in a time-of-flight spectrometer. The absorption of up to six additional photons in the continuum could be observed at 532 nm.

57771 **Continuum transitions in multiphoton-ionization and electron scattering.** Schwier, H.; Jetzke, S.; Hippler, R.; Lutz, H.O. (Universitaet Bielefeld (West Germany)). pp 43-57 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

Since the availability of high-power laser pulses the interaction of electrons with radiation fields has received increased attention. Among the multitude of related processes two aspects have received attention: (i) an electron which is ejected from an atom by the action of a radiation field, $A + n^{*}hw \rightarrow A^{+} + e^{-}$, can continue to interact with this field after absorption of the minimum number N of photons required for ionization; (ii) ATI processes may be viewed as half-collisions, a comparison to continuum transitions in laser-assisted electron-atom collisions A + e⁻(E/sub i/) +/- nhw → A* + e⁻(E/sub f/) is interesting since both phenomena are closely related.

57772 **Discussion of the role of many-electron motions in multiphoton ionization and excitation.** Boyer, K.; Jara, H.; Luk, T.S.; McIntyre, I.A.; McPherson, A.; Rosman, R.; Solem, J.C.; Rhodes, C.K.; Szoeke, A. (Lab. for Atomic, Molecular, and Radiation Physics, Chicago, IL (USA)). pp 58-69 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

The character of many-electron interactions in atoms is examined in relation to a possible role for these couplings in multiphoton processes. It is found that they provide a natural mechanism which can produce both (1) anomalously rapid rates of multiphoton ionization and (2) the direct production of electronically excited ionic species. Furthermore, it is determined that these two phenomena should be strongly correlated. On this basis, the experimental data concerning multiphoton ionization and the generation of fluorescence give evidence for a significant role for two-electron amplitudes in the heavy rare gases. For subpicosecond irradiation at 248 nm, the data indicate that the multi-electron processes become important above an intensity of $\sim 10^{14}$ W cm^{-2}, particularly for xenon. The trend exhibited by these findings suggests that multi-electron processes will become increasingly prominent at intensities above $\sim 10^{16}$ W cm^{-2}.

57773 **Stepwise process of doubly charged barium ions formation.** Bondar, I.I.; Lengyel, V.I.; Suran, V.V.; Delone, N.B.; Preobrazhensky, M.A. (Uzhgorod State Univ. (USSR)). pp 70-81 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

The results of experimental investigations of process of doubly charged ions formation in non-linear ionization of Ba atom by laser radiation in spectrum region omega = 14,900-18,700 cm^{-1} are presented. The preliminary results of this investigation have been published in previous works. The method of intersecting a laser beam with the neutral Ba atom beam was used. Dye-laser radiation was used as a source of ionization. The dependence of production of singly charged Ba^{+} and doubly charged Ba^{++} ions as a function of laser radiation frequency was measured while the polarization was linear and the field strength was fixed. Very clear resonance maxima in Ba^{+} (omega) and Ba^{++} (omega) are observed. A small change of the magnitude of field strength does not produce any change in the position of resonance maxima.

57774 **Quasiclassical approach to multiphoton ionization of hydrogen atoms.** Bersons, I.J. (Institute of Physics, Riga (USSR)). pp 82-87 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

For optical fields of moderate intensities, perturbation theory to the lowest nonvanishing order is an appropriate approach to the calculation of the ionization cross sections of hydrogen atoms. High order perturbation theory is used for the calculation of the ionization cross sections of both the ground state and excited states. However, the above-threshold ionization is observed for more intensive fields. Disappearance of the first above-threshold ionization peaks with the laser field intensity increase could be scarcely explained by the perturbation theory. Because there is no full coincidence between quantum-mechanical and classical calculations and it is not clear for what field frequencies and intensities the classical mechanic is correct, the quasiclassical theory development is reasonable, and what is more, it is suitable for the description of highly excited atoms. The quasiclassical theory is convenient for analytical solution, but not for numerical calculations. Since the problem of electron motion simultaneously in the Coulomb and oscillating electric fields has no exact analytical solution even in terms of the classical mechanics, some extra approximations in the quasiclassical theory should be used too.

57775 **Numerical experiments on above-threshold ionization.** Javanainen, J.; Eberly, J.H. (Univ. of Rochester, NY (USA)). pp 88-96 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

Ionization experiments are conducted numerically by integrating the Schroedinger equation of a one-dimensional model atom in an external field. The results are compared with elementary theoretical concepts. Whatever is the outcome, it is not distorted by unessential complications of real laboratory setups. The threshold shift and channel closing suggested as a possible mechanism of the peak suppression are demonstrated. Next a free-electron scaling is pointed out for the number of ATI peaks with the intensity and frequency of the field. This is evidence in favor of the continuum-dressing mechanism of ATI. Finally two Keldysh-type final-state dressing models are compared with the numerical experiments. Although the quantitative agreement is bad, there is a qualitative resemblance between Keldysh-type predictions and the simulations.

57776 **Multiphoton absorption and diffusion in a continuous and quasicontinuous atomic spectrum.** Fedorov, M.V. (General Physics Institute, Moscow (USSR)). pp 97-105 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

If a discrete atomic spectrum is dense enough (near the threshold) the process of its excitation (below threshold excitation, BTE) can be expected to be very similar to ATI. On the other hand BTE is very often described as a diffusion. For ionization, the diffusion model (DM) was suggested for the first time by Delone et al. The question to answer is which of these two models (DM or that similar to ATI) is more appropriate to describe the processes of BTE. One of the limits is evident: when the field frequency omega is less than that of atomic motion (eta^{-3} for atomic Rydberg level with the principle quantum number eta_0) there can be no analogy with ATI. Here the opposite case omega > eta_0^{-3} is considered.

57777 **Finite Fermi systems method for multiphoton processes in many-electron atoms.** Rapoport, L.P.; Agre, M.Ya. (Voronezh State Univ. (USSR)). pp 106-115 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

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The advantage of the theory of finite Fermi systems (TFFS) in application to the multiphoton processes in atoms consists in the fact that the integral equations can be obtained for an effective interaction of electrons and an effective vertex. Using the solutions of these equations, an arbitrary complex diagram for a multiphoton process in a many-electron atom can be composed of the blocks thus available. The theory of multiphoton processes in many-electron atoms is developed using general ideas of the TFFS.

57778 **Theory of multiphoton ionization of atoms by strong, short pulsed lasers.** Kulander, K.C. (Lawrence Livermore National Lab., CA (USA)). pp 116-123 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—). Contract W-7405-ENG-48.

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A numerical technique for investigating the behavior of many electron atoms in intense laser fields is presented. A description of the method is followed by results of an illustrative, application to helium for a number of wavelengths and intensities. A discussion of high order ionization dynamics for this system based on these calculations is provided.

57779 **Multiresonant spectroscopy and dynamics of molecular Rydberg states.** Haber, K.S.; Campos, F.X.; Zwanziger, J.W.; Wiedmann, R.T.; Grant, E.R. (Purdue Univ., West Lafayette, IN (USA)). pp 126-136 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

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Nonradiative dynamics in high-lying Rydberg neutral and autoionizing channels of NO_2 are characterized by optical-UV double resonant and multiresonant Rydberg-Rydberg absorption spectroscopy, as well as picosecond pump-probe time-resolved decay.

57780 **Photoelectron studies of multiphoton processes in small molecules.** Pratt, S.T.; O'Halloran, M.A.; Tomkins, F.S.; Dehmer, J.L.; Dehmer, P.M. (Argonne National Lab., IL (USA)). pp 137-148 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—). Contract W-31-109-ENG-38.

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

The three photon resonant, four photon ionization (3+1) spectra of H_2 via the C ^{1}II/sub u/, v' = 0 - 4 levels display strong non-Franck-Condon behavior that is not reproduced by calculations that assume direct excitation from the C ^{1}II/sub u/ Rydberg state into the ionization continuum. Recently, an explanation for this behavior has been proposed that involves an autoionizing, doubly-excited electronic state at the four photon energy. This explanation is examined in light of new (3+1) spectra obtained via the C ^{1}II/sub u/, v' = 0 - 4 levels of D_2. The new data support the explanation based on autoionization of a doubly excited state.

57781 **State-to-State study of collision induced energy transfer.** Sha, G.; Proch, D.; Kompa, K.L. (Max-Planck-Institut fuer Quantenoptik, Garching (West Germany)). pp 184-192 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

Three related experiments were performed to obtain state resolved data on collisional energy transfer. The energized molecule in each case is N_2 which has been selectively prepared by two-photon excitation of thermal ground state N_2.

57782 **Experimental signatures of atomic many-photon absorption in the classically chaotic regime.** Bayfield, J.E. (Univ. of Pittsburgh, PA (USA)). pp 236-244 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

Hydrogenic atoms and ions in excited states with large quantum numbers can be exposed to low frequency electromagnetic waves where one hundred photons must be absorbed from the wave for ionization of the atom. The system of the atom in the electric field of the wave exhibits semiclassical behavior at sufficiently high field strengths. The semiclassical time evolution is supported by the dynamics of ensembles of classical electron trajectories. The hydrogen-in-microwaves system exhibits semiclassical behavior at high microwave field strengths. Experimental data for final bound state distributions are in qualitative agreement with both quantal numerical calculations and classical numerical calculations. Precision comparisons await better experimental and theoretical characterization of the microwave field switching. The same is true for ionization probabilities, where experimental data qualitatively agree with classical numerical calculations and with quantal numerical calculations.

57783 **Quantum-mechanical aspects of classically chaotic driven systems.** Milonni, P.W.; Ackerhalt, J.R.; Goggin, M.E. (Los Alamos National Lab., NM (USA)). pp 245-251 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

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Quantum systems with discrete energy levels are obviously quasiperiodic, and therefore cannot exhibit chaos in the classical sense of a positive Lyapunov exponent. Here they are interested in driven quantum systems, and in particular in atoms and molecules in laser fields. For periodically driven quantum systems it has been established that (a) the dynamics is recurrent, and (b) a quantum localization effect can suppress the classical diffusion in phase space and the consequent stochastic excitation. Since the recurrence time can be very long and experimentally uninteresting, this investigation will focus the possibility of stochastic excitation in a driven quantum system.

57784 **Exponential photonic localization and chaos in the hydrogen atom in a monochromatic field.** Casati, G.; Guarneri, I. (Universita degli Studi di Milano (Italy)). pp 252-262 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

The authors show that in highly excited hydrogen atoms irradiated by a monochromatic microwave field the energy distribution over unperturbed levels is exponentially localized in the number of absorbed photons. This result, which is a quantum manifestation of classical chaos, explains the presence of a large ionization peak a frequencies much below those required for the conventional one-photon photoelectric effect.

57785 **Vibrational chaos in infrared multiphoton excitation of polyatomic molecules.** Ryabov, E.A. (Institute of Spectroscopy, Troitzk (USSR)). pp 263-270 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

A random, stochastic character of vibrational molecular motion is in line with a statistical distribution of energy among all the modes of the molecule. For this reason, the effect of stochastization can be studied by analyzing the intramolecular energy distribution, the dynamics of its establishment in the various modes when one of them is being acted upon in a resonant manner. In this respect, a convenient method for preparing molecules is the IR multi-

photon excitation (MPE) effect which occurs at resonance between an intense laser radiation and one of the molecular vibrations. The results of experimental studies into the stochastization of vibrational motion taking place upon the IR MPE of polyatomic molecules are presented.

57786 **Formation and decay of triply excited He^- states in e-He scattering.** Heideman, H.G.M. (Rijksuniversiteit Utrecht (Netherlands)). pp 272-291 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

Most of our current understanding of atomic physics and most of its nomenclature stems from the independent-electron model. During the past decade or so several other experiments have revealed an increasing number of effects and processes (both in atomic structure and in collision processes), for the description of which the independent-electron model is highly inadequate. Such effects occur most prominently in system where two or more electrons are simultaneously excited (multiply excited states) and manifest themselves in highly correlated motions of the (excited) electrons involved. Alternatively they may occur in the near-threshold excitation of an atom by an electron, where the projectile electron loses so much energy that its velocity after the collision becomes comparable to that of the excited atomic electron(s). As the multiply excited states to be studied in this paper are formed in the near-threshold electron impact excitation of atoms, the latter type of electron correlation shall be discussed in some more detail. For simplicity two-electron correlations are considered as an example.

57787 **Hyperspherical description of multiply excited states.** Watanabe, S. (Observatoire de Paris, Meudon (France)). pp 292-303 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

Analogy between multiply excited states and rovibrational modes of molecules provides a simple image of strongly correlated electrons. It facilitates to classify a large number of quasibound states and to understand various phenomena due to the electron correlation. They describe this viewpoint, using simple examples of doubly and triply excited states.

57788 **Contribution of autoionizing states in multiphoton ionization of atoms with two valent electrons.** Lengyel, V.I.; Haysak, M.I. (Uzhgorod State Univ. (USSR)). pp 304-316 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

The theoretical study of two-photon one-electron ionization of calcium atom is carried out. Quasienergy method is used. The contribution of autoionizing states is taken into account. The parameters of the latter are calculated within the method of configuration interaction. The numerical calculations were carried out by taking into account up to 50-60 configurations of outer electrons. The resonance structure of the cross-section of ionization is obtained which is due to the contribution of autoionizing states. The change of this contribution is studied in a strong radiation field.

57789 **Nonlinear optical balance.** Wynne, J.J. (IBM T.J. Watson Research Center, Yorktown Heights, NY (USA)). pp 318-327 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

An analysis is presented of four-wave mixing processes with a single resonant intermediate state and it is shown how the waves evolve to a condition of nonlinear optical balance. The case of exact resonance is treated explicitly to show how the balance condition is one that minimizes dissipative losses. In fact, combinations of the various waves with relative amplitudes and phases different from that describing the balance are more rapidly damped out, leaving the minimum loss combination to persist the longest. Another way to look at the balance is to recognize that it is stabilized by the dissipative processes that increase the losses if the balance is upset in either direction.

57790 **Influence of internally generated fields on odd photon pumping of dipole-allowed transitions in atomic gases.** Garrett, W.R. (Oak Ridge National Lab., TN (USA)). pp 328-337 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

The dramatic influence of multiwave mixing processes on resonant multiphoton excitation of dipole-allowed quantum transitions are discussed. Brief comparisons are made between different theoretical approaches used in treating the same underlying physics, and between the predictions and available experimental manifestations of the phenomenon for three-photon and five-photon induced processes.

57791 **Nonclassical radiation from one-atom oscillators.** Diedrich, F.; Krause, J.; Rempe, G.; Scully, M.O.; Walther, H. (Universitaet Muenchen, Garching (West Germany)). pp 338-348 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

The interaction of a single Rydberg atom with a single mode of the electromagnetic field and the resonance fluorescence of a single atomic ion stored in a radio-frequency trap were investigated. In the former experiment, the quantum collapse and the revival of the atomic inversion predicted by the Haynes-Cummings model could be demonstrated for the first time. In the latter experiment, antibunching and sub-Poissonian photon statistics were detected in the fluorescent light.

57792 **Comments on major problems in multiphoton processes.** Lambropoulos, P. (Max-Planck-Institut fuer Quantenoptik, Garching (West Germany)). pp 350-356 of Multiphoton processes: Proceedings. Smith, S.J.; Knight, P.L. (eds.). Cambridge, England; Cambridge University Press (1988). (CONF-870789—).

From 4. international conference on multiphoton processes (ICOMP IV); Boulder, CO, USA (13 Jul 1987).

Above threshold ionization, multiple ionization and internally generated harmonics under strong pulsed lasers are summarized and possible interconnections are discussed.

57793 **Astable resonator photoneutralization apparatus.** Fink, J.H. US Patent Application 6-051,561. 19 May 1987. 38p. Contract W-7405-ENG-48. NTIS, PC A03/MF A01.

Apparatus for photoneutralization of negatively charged atomic or molecular particles, using multiple passes of electronmagnetic radiation of predetermined wavelength. 8 figs.

6404 Fluid Physics

REFER ALSO TO CITATION(S) 58031

57794 (INIS-SU—49, pp 31-38) **Superfluid turbulence in helium in annuli channels at transient heat fluxes.** Miklyaev, V.M.; Sergeev, I.A.; Filippov, Yu.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1987. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89780012/JAW.

Preprint 5(25)-87.

In JINR rapid communications. Collection.

The experimental results of investigation of transient termal processes in superfluid helium and He II - solid interface are presented. The qualitatively new data on dynamics of processes of transient heat transfer into He II in annuli channels are obtained. A number of effects are discovered, which follow, on authors' opin-

ion, from the begginning of superfluid turbulence state in He II. Superfluid turbulence parameters relations with the experimental conditions are discussed. The dependence of vortex generation time on heat load is determined. 16 refs.; 3 figs.

57795 **(LA-UR—88-2672) Numerical implication of Riemann problem theory for fluid dynamics.** Menikoff, R. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 8p. (CONF-8805194—1). NTIS, PC A02/MF A01. Order Number DE88016326/JAW.

From 6. Army conference on applied mathematics and computing; Boulder, CO, USA (31 May 1988).

The Riemann problem plays an important role in understanding the wave structure of fluid flow. It is also crucial step in some numerical algorithms for accurately and efficiently computing fluid flow; Godunov method, random choice method, and from tracking method. The standard wave structure consists of shock and rarefaction waves. Due to physical effects such as phase transitions, which often are indistinguishable from numerical errors in an equation of state, anomalkous waves may occur, "rarefaction shocks", split waves, and composites. The anomalous waves may appear in numerical calculations as waves smeared out by either too much artificial viscosity or insufficient resolution. In addition, the equation of state may lead to instabilities of fluid flow. Since these anomalous effects due to the equation of state occur for the continuum equations, they can be expected to occur for all computational algorithms. The equation of state may be characterized by three dimensionless variables: the adiabatic exponent γ, the Grueneisen coefficient Γ, and the fundamental derivative G. The fluid flow anomalies occur when inequalities relating these variables are violated. 18 refs.

57796 **(LA-UR—88-3239) Noise-induced intermittency in the quasiperiodic regime of Rayleigh-Benard convection.** Ecke, R.E.; Haucke, H. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 33p. (CONF-8803149—1). NTIS, PC A03/MF A01. Order Number DE89000319/JAW.

From External noise and its interaction with spatial degrees of freedom in nonlinear dissipative systems; Los Alamos, NM, USA (28 Mar 1988).

Thermal measurements on a convecting dilute ^{3}He-superfluid ^{4}He solution in the quasiperiodic regime show a transition from a mode-locked periodic state to chaotic time dependence via intermittency. In a region just below the onset of intermittency, injection of external multiplicative noise with noise amplitude above a certain threshold level induces the chaotic state. This noise-induced transition can be understood to be due to perturbation of a system with a barely stable attractor; the noise causing the system to escape the weakly attracting periodic points. We present numerical simulations and experimental data which support this picture. 13 refs., 13 figs.

57797 **(LA-UR—88-3285) Spatiotemporal chaos is one- and two-dimensional coupled map lattices.** Kaneko, Kunihiko. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 35p. (CONF-8805120—3). NTIS, PC A03. Order Number DE89000325/JAW.

From CNLS conference on advances in fluid turbulence; Los Alamos, NM, USA (16 May 1988).

Coupled map lattices are investigated as a model for spatiotemporal chaos. Pattern dynamics in diffusively coupled logistic lattice is briefly reviewed with the use of power spectra, domain distribution, and Lyapunov spectra. Mechanism of pattern selection with the suppression of chaos is discussed. Pattern dynamics on a 2-dimensional lattice is shown. In a weak coupling regime, a similarity with the one-dimensional case is found; frozen random pattern, pattern selection, Brownian motion of a chaotic string, and intermittent collapse of the pattern with selective flicker noise. In a strong coupling regime, frozen pattern is found to be unstable by the surface tension, which is in contrast with the one-dimensional case. Convective coupling model is introduced in connection with the fluid turbulence of Navier--Stokes type. Soliton turbulence and vortex turbulence in the model are reported. Physical implications of coupled map lattices are discussed.

57798 **(PB—88-867965/XAB) Computational fluid dynamics: complex flows requiring supercomputers. January 1975-July 1988 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-July 1988.** (National Technical Information Service, Springfield, VA (USA)). Aug 1988. 45p. NTIS PC N01/MF N01.

This bibliography contains citations concerning computational fluid dynamics (CFD), a new method in computational science to perform complex flow simulations in three dimensions. Applications include aerodynamic design and analysis for aircraft, rockets, and missiles, and automobiles; heat-transfer studies; and combustion processes. Included are references to supercomputers, array processors, and parallel processors where needed for complete, integrated design. Also included are software packages and grid-generation techniques required to apply CFD numerical solutions. Numerical methods for fluid dynamics, not requiring supercomputers, are found in a separate published search. (Contains 83 citations fully indexed and including a title list.)

57799 **(UCID—21527) An investigation of the finite element incompressible flow code FEM3: The model, some of its options, a guide in how to obtain and run the code, and its performance on some chosen problems.** McCallen, R.C. (Lawrence Livermore National Lab., CA (USA)). Sep 1988. Contract W-7405-ENG-48. 66p. NTIS, PC A04/MF A01. Order Number DE89001631/JAW.

A review of incompressible flow codes was made to locate codes which would best fit the NTED Thermo-Fluids Group needs. The LLNL code FEM3 was chosen for evaluation. Using the FEM3 code, we have successfully modeled a one-dimensional advection/diffusion problem, the flow over a two-dimensional backward facing step, and the flow through an abrupt expansion in a circular pipe. The FEM3 code accurately predicted these chosen flow problems. Computer time savings and effects on accuracy when running with various solution options were investigated. Also examined were the various boundary condition options. A number of published FEM3 predictions for natural convection problems were reviewed. Since the problems considered were for convection in closed cavities, for which the code behaved very well, the code's ability to accurately and efficiently solve natural convection problems for a heated surface immersed in a fluid has not been determined. Application of the FEM3 code to the chosen problems was found to be straightforward and the existing users manuals gave adequate guidance. A description of some of the new input options, example input files, along with more detailed guidance to option choices is included in this report. 16 refs., 17 figs.

57800 **(UCRL—53882) A centered artificial viscosity for cells with large aspect ratio.** Margolin, L.G. (Lawrence Livermore National Lab., CA (USA)). 15 Aug 1988. Contract W-7405-ENG-48. 29p. NTIS, PC A03/MF A01. Order Number DE89000604/JAW.

The author has developed a new artificial viscosity for numerical fluid dynamics codes in two dimensions. The formulation combines the advantages of cell-centered treatment with the ability of the edge-centered method to handle cells with large aspect ratio. This report describes the derivation of the new viscosity, whose magnitude and tensor properties both differ from standard treatments. The new viscosity has been implemented in the SHALE code. Calculations on two variations of a test problem representing a shock propagating obliquely through a two-dimensional mesh are presented. 14 refs., 13 figs.

57801 **(UCRL—99406) Solving the incompressible Navier--Stokes equations using consistent mass and a pressure Poisson equation.** Gresho, P.M.; Chan, S.T. (Lawrence Livermore National Lab., CA (USA)). Aug 1988. Contract W-7405-ENG-48. 25p. (CONF-881192—1). NTIS, PC A03/MF A01. Order Number DE89001241/JAW.

From Symposium on recent developments in computational fluid dynamics; Chicago, IL, USA (28 Nov 1988).

We derive and demonstrate a new technique for solving the time- dependent incompressible Navier--Stokes equations using low-order (bilinear) finite elements. The scheme is based on using the

consistent mass matrix for the physical processes of advection and diffusion, and the lumped mass approximation for the pressure gradient term. The implementation uses a simple semi-implicit projection method based on the original method of Chorin. It is shown that the new scheme is cost-effective, relative to those using either lumped or consistent mass everywhere, especially for simulations in which accuracy of the advective (convective) transport process is particularly important. Steady results obtained from the scheme, which are slightly less accurate, are also addressed. 18 refs., 11 figs., 3 tabs.

57802 **(UCRL—99503) Semi-consistent mass matrix techniques for solving the incompressible Navier-Stokes equations.** Gresho, P.M.; Chan, S.T. (Lawrence Livermore National Lab., CA (USA)). Sep 1988. Contract W-7405-ENG-48. 53p. (CONF-880936—4). NTIS, PC A04/MF A01. Order Number DE89001299/JAW.

From 1. international conference on computational methods in flow analysis; Okayama, Japan (5 Sep 1988).

We have described, partially analyzed, and demonstrated three schemes that retain the consistent mass matrix in the Navier-Stokes equations in a cost-effective way relative to either CM everywhere or LM everywhere; viz., by lumping the mass only in the pressure gradient term and solving sequential and uncoupled systems in the context of semi-implicit time integration (implicit for diffusion, explicit for advection) and a pressure Poisson equation. All three deliver nearly the same results as each other and for nearly the same cost as a semi-implicit lumped mass scheme. All three have been shown to be superior to lumped mass methods for flows in which advection accuracy is important. While a relative ranking is difficult, the first of these, PPE, seems to be the worst in that it shows more disadvantages than advantages: (1) it displays an inconsistency at $t = O^+$, (2) it delivers non-divergence-free solutions that are both larger than those from the equivalent LM scheme and non-vanishing at steady state, (3) it is slightly less stable, and (4) it is slightly more expensive and slightly more dissipative. Its single advantage seems to be in the application of boundary conditions: they are clearly proper and unambiguous. Projection 1 has the disadvantage that even SS results depend on Δt. While Projection 2 still seems to have somewhat of a "theoretical" (or perhaps intuitive) edge over Projection 1, in practice the two schemes have been so close that the simplicity and (very slightly) reduced cost of Projection 1 would seem to favor it. Perhaps more effort on Projection 2 would be fruitful, but we are not sure at this time. 30 refs., 19 figs.

57803 **Equation of state for the hard-sphere gas.** Goldman, J.I.; White, J.A. (Department of Physics, The American University, Washington, DC 20016). *Journal of Chemical Physics;* **89**: No. 10, 6403-6405(15 Nov 1988).

Two equations are suggested to describe the hard-sphere system interpolating between gas and close-packed configurations. They indicate some instability and possible phase transition in the same region as that in the Adler and Wainwright molecular dynamics simulation.

57804 **Vortex-in-cell simulation of bubble competition in a Rayleigh–Taylor instability.** Zufiria, J.A. (Mathematical Sciences Department, IBM Thomas J. Watson Research Center, Yorktown Heights, New York 10598). *Physics of Fluids;* **31**: No. 11, 3199-3212(Nov 1988).

The penetration of a front of light fluid into a heavy fluid in a Rayleigh–Taylor unstable flow is studied by using a vortex-in-cell numerical algorithm. The algorithm is used to simulate the competition among the bubbles that are formed in the interface when the density ratio of the two fluids is very large. Several multifrequency initial conditions and the effect of surface tension have been considered. It is found that the front moves with constant acceleration. The values obtained for the acceleration of the front are in very good agreement with experimental results obtained by Read [Phys. D 12, 45 (1984)] and with the results obtained by using Zufiria's [Phys. Fluids 31, 440 (1988)] model.

57805 **Cascade and intermittency model for turbulent compressible self-gravitating matter and self-binding phase-space density fluctuations.** Biglari, H.; Diamond, P.H. (Department of Physics, University of California at San Diego, La Jolla, California 92093). *Physical Review Letters;* **61**: No. 15, 1716-1719(10 Oct 1988).

A simple physical model which describes the dynamics of turbulence and the spectrum of density fluctuations in compressible, self-gravitating matter and self-binding, phase-space density fluctuations is presented. The two systems are analogous to each other in that each tends to self-organize into hierarchical structures via the mechanism of Jeans collapse. The model, the essential physical ingredient of which is a cascade constrained by the physical requirement of quasivirialization, is shown to exhibit interesting geometric properties such as intrinsic intermittency and anisotropy.

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 57351, 57704, 57953

57806 **(BNL—41636) Search for QGP signals at AGS with a TPC spectrometer, and comparison of our event generator predictions for plasma model and cascade interactions.** Lindenbaum, S.J.; Foley, K.J.; Eiseman, S.E.; Etkin, A.; Hackenburg, R.W.; Longacre, R.S.; Love, W.A.; Morris, T.W.; Platner, E.D.; Saulys, A.C. (Brookhaven National Lab., Upton, NY (USA)). 21 Jun 1988. Contract AC02-76CH00016;AS05-81ER40032;AC02-76ER03274;AC02-83ER40107. 10p. (CONF-8805142—30). NTIS, PC A02/MF A01. Order Number DE88016137/JAW.

From 3. international conference on the intersections between particle and nuclear physics; Rockport, ME, USA (14 May 1988).

We have developed and successfully tested a TPC Magnetic Spectrometer to search for QGP signals produced by ion beams at AGS. We also developed a cascade and plasma event generator the predictions of which are used to illustrate how our technique can detect possible plasma signals. 4 refs., 6 figs., 1 tab.

57807 **(BNL—41728) Status of a study of the decay $K^+ \rightarrow \pi^+ \nu\{\text{bar } \{\text{nu}\}\}$.** Strand, R.C. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 9p. (CONF-8805142—42). NTIS, PC A02/MF A01. Order Number DE89001086/JAW.

From 3. international conference on the intersections between particle and nuclear physics; Rockport, ME, USA (14 May 1988).

AGS-787, BNL-Princeton-TRIUMF, began taking data in February 1988 on rare K^+ decays into π^+ and non-interacting neutrals. Recent observations of B-{bar B} mixing have sharpened the branching ratio prediction of the three generation standard model, (SM), to {approximately} 1-5 {times} 10^{-10} for $\pi^+ \nu\{\text{bar } \{\text{nu}\}\}$. The detector has 2π acceptance for this decay and 4π acceptance for background gammas. A very large window for viewing new physics exists between the SM value and the previous experimental limit of 1.4 {times} 10^{-7}. Several other predicted rare K^+ decays can be detected. The performance of the detector is described. 8 refs., 4 figs.

57808 **(CEA-N—2569) Study of charm photoproduction using a silicon vertex detector. Measurement of the lifetime of D mesons.** Primout, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires). Jun 1988. 309p. (In French). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88754997/JAW.

In this thesis, we were interested in fully reconstructed charmed events, using the results from NA14/2 experiment at CERN. A filtering program, using the active target information, have been developed. D/sup +/ and D/sup 0/ lifetimes have been measured using samples of events with a very good signal to noise ratio. We find values in good agreement with previous experimental results. In addition, the study of the silicon recoil nucleus in the de-

tector enables us, to set a limit on the coherent charm photoproduction cross section.

57809 **(DOE/ER/40325—12A) Log-s physics with CDF.** White, S. (Rockefeller Univ., New York (USA)). 1988. Contract AC02-87ER40325. 15p. (CONF-880288—5; RU—88/E-20). NTIS, PC A03/MF A01. Order Number DE89001157/JAW.

From Les Recontres de Physique; La Thuile, Italy (28 Feb 1988).

We discuss results from minimum bias data taken during the 1987 collider run with emphasis on inclusive charged particle distributions measured with the CDF tracking detectors. 7 refs., 10 figs.

57810 **(IFVE-OEIUNK—87-80) Impact parameter analysis of proton-proton elastic and inelastic interactions at 360 GeV/c.** Banerjee, S.; Ragavan, R.; Bailly, J and others. (Tata Inst. of Fundamental Research, Bombay (India); Mons Univ. (Belgium)). (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1987. 19p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704339/JAW.

Submitted to the journal Sov. J. Nuck. Phys. .

Data obtained with the European Hybrid Spectrometer on the proton-proton elastic scattering at 360 GeV/c are presented. The differential cross sections of elastic and inelastic pp-interactions are studied as a function of the impact parameter. The results are compared to those obtained at other energies. They are interpreted in the framework of a simple geometrical Monte-Carlo model of inelastic collisions considering protons as composite particles having a definite effective radius with valence quarks inside. The shape of the inelastic overlap function is well reproduced for both pp- and π/sup +/p-interactions. The effective radii of the proton and pion as well as of the valence quarks are estimated for inelastic interactions. The model calculations indicate an increase of the effective radii both of protons and valence quarks and an increase of the proton opacity with increasing energy. 12 refs.; 11 figs.; 4 tabs.

57811 **(LA-UR—88-3028) Feasibility of detecting B → h/sup plus/h/sup minus/ in a fixed-target experiment.** Peng, J.C.; Mishra, C.S.; Moss, J.M.; McGaughey, P.; Kapustinsky, J. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 12p. (CONF-8805140—5). NTIS, PC A03/MF A01. Order Number DE89000366/JAW.

From International conference on medium- and high-energy nuclear physics; Taipei, Taiwan (23 May 1988).

We discuss a proposal to measure two-body, two-prong decays of neutral B mesons and Λ/sub b/ in an 800 GeV fixed-target experiment. We expect to obtain a large sample ({approximately}10^9 events) of these decays if the branching ratios are {approximately}5 {times} 10/sup {minus}5/. 23 refs., 2 figs., 3 tabs.

57812 **(LA-UR—88-3031) Parity nonconservation in the proton-deuteron total cross section at 800 MeV.** Mischke, R.E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 7p. (CONF-880983—3). NTIS, PC A02/MF A01. Order Number DE89000363/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

A measurement of parity nonconservation in the transmission of 800-MeV longitudinally-polarized protons through an unpolarized, one- meter liquid-deuterium target is discussed. The apparatus was essentially that same as for a previous measurement of the effect in p-p scattering. The longitudinal asymmetry is measured from the change in transmission of the beam through the target as the helicity of the beam is reversed. The preliminary result is A/sub L/ = (1.7 +- 0.8(stat) +- 1.0(sys)) {times} 10/sup {minus}7/. Further study of the dependence of transmission on beam properties should allow the estimate of systematic errors to be reduced and may alter the central value of the result. 11 refs., 2 figs., 1 tab.

57813 **(LA-UR—88-3193) Falling antimatter: An experiment to measure the gravitational acceleration of the antiproton.** Dyer, P.; Camp, J.; Holzscheiter, M.H.; Graessle, S. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 15p. (CONF-881151—4). NTIS, PC A03/MF A01. Order Number TI89000313/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

According to some theories of gravity, antimatter will fall faster than matter in the earth's gravitational field. An experiment to measure the gravitational force on the antiproton is under construction. Antiprotons of a few MeV from the LEAR facility of CERN will be slowed down and caught in a large Penning electromagnetic trap. They will then be cooled and transferred to Penning cooling and launching traps. The gravitational acceleration will be measured by the time-of-flight in a drift tube shielding stray electronic fields, and will be compared with that measured for H/sup {minus}/ ions. Progress on a number of fronts is described. 9 refs., 2 figs.

57814 **(LBL—24772) High energy nucleus-nucleus collisions at CERN: Signatures, physical observables and experimental results.** Harris, J.W. (Lawrence Berkeley Lab., CA (USA)). Feb 1988. Contract AC03-76SF00098. 16p. (CONF-880147—3). NTIS, PC A03/MF A01. Order Number DE88016629/JAW.

From 11. symposium on nuclear physics; Oaxtepec, Mexico (4 Jan 1988).

Experimental results on high energy nucleus-nucleus collisions have become available with the recent experiments at CERN utilizing 200 GeV/n oxygen and sulfur beams. Physics motivations for these experiments are presented: a description of predicted signatures for possible formation of a quark-gluon plasma and physical observables that are expected to provide important information for understanding the dynamics of these collisions. A presentation will be made of some of the first experimental results to emerge from this new field. 28 refs., 9 figs.

57815 **Analyzing-power measurement in inclusive π0 production at high x/sub F/.** Bonner, B.E.; Buchanan, J.A.; Carey, D.C.; Clement, J.M.; Coleman, R.N.; Corcoran, M.D.; Cossairt, J.D.; Derevshchikov, A.A.; Grosnick, D.P.; Hill, D.A.; and others. (T. W. Bonner Nuclear Laboratory, Rice University, Houston, Texas 77251-1892). *Physical Review Letters;* **61**: No. 17, 1918-1921(24 Oct 1988).

The analyzing power A/sub N/ in inclusive π^0 production has been measured by use of new 185-GeV/c Fermilab polarized proton beam. We obtain the value A/sub N/ = 0.10 +- 0.03 for π^0's in the kinematic region 0.2<x/sub F/<0.8 and 0.3<p/sub T/<1.2 GeV/c. In certain models of particle production this suggests that the spin of the proton is carried by its valence quarks.

57816 **Limits on nu-bar/sub μ/→nu-bar/sub e/ oscillations.** Durkin, L.S.; Harper, R.W.; Ling, T.Y.; Mitchell, J.W.; Romanowski, T.A.; Smith, E.S.; Timko, M.; Freedman, S.J.; Napolitano, J.; Fujikawa, B.K.; and others. (The Ohio State University, Columbus, Ohio 43210). *Physical Review Letters;* **61**: No. 16, 1811-1814(17 Oct 1988).

The result of a search for the neutrino oscillation mode nu-bar/sub μ/→nu-bar/sub e/ in a fine-grained tracking detector is reported. The average neutrino energy is 40 MeV and the average detector distance from the neutrino source is 26.8 m. No evidence for neutrino oscillations through this mode is observed. Limits on δm^2 and $\sin^2(2\theta)$ are presented.

57817 **Transverse-momentum distributions of charged particles produced in p-barp interactions at $\sqrt{s}$-bar = 630 and 1800 GeV.** Abe, F.; Amidei, D.; Apollinari, G.; Ascoli, G.; Atac, M.; Auchincloss, P.; Baden, A.R.; Barbaro-Galtieri, A.; Barnes, V.E.; Bedeschi, F.; and others. (Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review Letters;* **61**: No. 16, 1819-1822(17 Oct 1988).

Measurements of inclusive transverse-momentum spectra for charged particles produced in proton-antiproton collisions at $\sqrt{2}$ of

630 and 1800 GeV are presented and compared with data taken at lower energies.

57818 Nuclear transparency to large-angle pp elastic scattering. Carroll, A.S.; Barton, D.S.; Bunce, G.; Gushue, S.; Makdisi, Y.I.; Heppelmann, S.; Courant, H.; Fang, G.; Heller, K.J.; Marshak, M.L.; and others. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review Letters;* **61**: No. 15, 1698-1701(10 Oct 1988).

Large-angle pp elastic and quasielastic (p,2p) scattering have been simultaneously observed in hydrogen and each of several nuclear targets (Li, C, AL, Cu, Pb) at incident proton momenta of 6, 10, and 12 GeV/c. The nuclear transparency is the ratio of such a cross section in a nucleus to the free pp cross section. The transparency of aluminum increases with incident momentum by more than a factor of 2 from 6 to 9.5 GeV/c and falls significantly between 9.5 and 12 GeV/c. This occurs in a region where the free-proton nucleon-absorption cross section exhibits little energy dependence. QCD predicts an increase in transparency with energy.

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 57718

57819 (ANL-HEP-CP—40) Δσ/sub L/}(pp) and jet physics. Richards, D.G. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 20p. (CONF-8806203—7). NTIS, PC A03/MF A01. Order Number DE89000600/JAW.

From Symposium on future polarization at Fermilab; Batavia, IL, USA (13 Jun 1988).

We show that there is a positive contribution to Δσ/sub L/(pp; s) = σ /sub tot/(p(+)p(+); s) {minus} σ/sub tot/(p(+)p({minus}); s) (where the +- refer to proton helicities) associated with the pointlike scattering of fundamental constituents. Simple arguments imply that this positive contribution would, at very high s, be larger in absolute value than the negative contribution to Δσ/sub L/ predicted from the exchange of the A_1 reggeon, and furthermore may provide important insight into the shape of the spin weighted quark and gluon distributions. Measurements of Δσ/sub L/ in the energy range $\sqrt{s}$ = 18 {minus} 30 GeV also should help clarify theoretical ideas associated with the observations of "minijets" and could aid in the prediction of event structure at future high energy colliders. 24 refs. 6 figs.

57820 (ANL-HEP-CP—88-34) Hyperfine interactions, the key to multiquark physics?. Likpink, H.J. (Argonne National Lab., IL (USA)). 8 Aug 1988. Contract W-31109-ENG-38. 18p. (CONF-880560—6). NTIS, PC A03/MF A01. Order Number DE89000610/JAW.

From Topical conference on nuclear quantum chromodynamics; Argonne, IL, USA (19 May 1988).

Clues in the search for a fundamental description of hadron physics based on QCD may be obtained from a phenomenological constituent quark model in which the color-electric force binds quarks into saturated color-singlet hadrons, and finer details of the spectrum and multiquark physics are dominated by the color-magnetic hyperfine interaction. 47 refs.

57821 (CMU-HEP—88-11) Introduction to rare kaon decays in standard model. Li, Ling-Fong. (Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Physics). 1988. Contract AC02-76ER03066. 32p. (CONF-8805140—6). NTIS, PC A03/MF A01. Order Number DE89000449/JAW.

From International conference on medium- and high-energy nuclear physics; Taipei, Taiwan (23 May 1988).

Rare kaon decays, K/sub L/ → {ell}{bar {ell}}, K/sup +-/ → π/sup +-/ν{bar {nu}}, $K^0 \rightarrow \gamma\gamma$, K/sup t/ → π/sup +-/e{bar e}, and $K^0 \rightarrow \pi^0 e\{\text{bar } e\}$ are reviewed in the standard model of electroweak interaction. 20 refs., 10 figs.

57822 (CMU-HEP—88-12) Chromoelectric and chromomagnetic effects in the confinement of gluons. Cutkosky, R.E. (Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Physics). 1988. Contract AC02-76ER03066. 6p. (CONF-8806249—1). NTIS, PC A02/MF A01. Order Number DE89000450/JAW.

From International symposium on hadron interactions - theory and phenomenology; Bechyne, Czechoslovakia (26 Jun 1988).

Results are presented from a new variational calculation of quantized SU(3) Yang-Mills fields. The Hamiltonian formalism is applied to the continuum theory, with a truncated momentum expansion in a finite volume, using the Coulomb gauge. The relative importance of electrical and magnetic effects is examined, using an improved treatment of paramagnetic effects. The results depend on the value of the interaction constant, with a transition at α {approximately} 0.4. For α > 0, there is a mass gap between the first excited state and the vacuum state, arising from properties of the Faddeev-Popov determinant. For a {approx←gt} 0.4, properties of the Coulomb energy operator lead to a second mass gap between the first and the higher excited states. 33 refs., 3 figs.

57823 (EFI—951(1)-87) Investigation of the proton structure function in the region of high momentum transfers. Grigoryan, L.A. (Erevanskij Fizicheskij Inst. (USSR)). 1987. 24p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704314/JAW.

The proton structure function in the region of high-momentum transfer in a wide range of x with total error of ~ 10%, measured by the European muon collaboration is used to find the theoretical model which best of all describes the range of large Q/sup 2/. Several models are considered which differ by the choice of initial conditions as well as how they account of the deviation from the scaling. The best agreement is obtained when the oscillator quark model is used as an initial condition and the QCD evolution taken into account by means of precise solution of Lipatov-Altarelli-Parisi equations. 19 refs.; 5 figs.; 1 tab.

57824 (EFI—960(10)-87) Conjoined hadroproduction of H/sub 0/-boson and /sup 1/S/sub 0/ state of heavy quarkonia. Bagdasaryan, A.S.; Egoryan, R.Sh. (Erevanskij Fizicheskij Inst. (USSR)). 1987. 24p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704318/JAW.

The total cross section of associated hardproduction of standard H/sub 0/ boson and /sup 1/S/sub 0/(eta/sub Q/) state of QQ-bar(Q=c,b,t...) heavy quarkonium is studied. Contributions of the so-called QH and GGH diagrams to the associated production cross section are analyzed. It is shown that with the growth of the Higgs boson mass, there "the effect of GGH contribution increase" takes place. 20 refs.; 9 figs.

57825 (IFUSP-P—646) Supersymmetric charged Higgs boson production at the SSC. Eboli, O.J.P.; Marques, G.C.; Novaes, S.F.; Natale, A.A.; Pulido, J.M.R. (Massachusetts Inst. of Tech., Cambridge (USA); Sao Paulo Univ. (Brazil). Inst. de Fisica; Instituto de Fisica Teorica, Sao Paulo (Brazil); Centro de Fisica de Materia Condensada, Lisboa (Portugal)). (Sao Paulo Univ. (Brazil). Inst. de Fisica). Jun 1987. 13p. (IFT-P—15/87). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703979/JAW.

We analyse the production of superymmetric charged Higgs bosons via vector boson fusion at SSC energies.

57826 (IFVE-OTF—87-181) Nontopological solitons in electroweak theory with heavy fermions. Petriashvili, G.G.; Rubakov, V.A. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij). (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1987. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704342/JAW.

A possibility of production and subsequent decay of bound states- nontopological solitons, is investigated in the framework of the standard electroweak theory, in which a heavy fermion doublet with masses 1-2 TeV is additionally included. The soliton mass dependence on the model parameters and that of fermion critical mass

on the value of Higgs boson mass are studied. A fermion with the mass exceeding the critical mass forms nontopological soliton. 4 refs.; 4 figs.

57827 **(IFVE-OTF—87-183) Real part of amplitude and hadron scattering cross section at superhigh energies.** Troshin, S.M.; Tyurin, N.E. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1987. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704343/JAW.

New data on measuring the ratio of the real to imaginary part of the forward scattering amplitude: rho/sub pp-bar/($\sqrt{s}$=546 GeV)=0.24+-0.04 have been considered. This result is shown to agree with the behaviour of σ/sub tot/(s), predicted by the U-matrix model. A possibility of transition to antishadow scattering mode at superhigh energies is stated. 10 refs.; 1 fig.

57828 (INIS-BR—1229, pp 73) **Excitation rates of heavy quarks.** Garcia C, C.A.; Santangelo, E.M.; Ducati, M.B. de L.G. (La Plata Univ. Nacional (Argentina)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57829 (INIS-BR—1229, pp 76) **Excitation of heavy quarks and dileptons production by neutrinos.** Ducati, M.B. de L.G. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57830 (INIS-BR—1229, pp 88) **S-wave meson-nucleon scattering in an SU(3) cloudy bag model.** Veit, E.A.; Jennings, B.K.; Thomas, A.W.; Barrett, R.C. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; TRIUMF, Vancouver, British Columbia (Canada); Adelaide Univ. (Australia); Surrey Univ., Guildford (UK)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57831 (INIS-BR—1229, pp 88) **KN scattering in the cloudy bag model: s, p and d waves.** Veit, E.A.; Thomas, A.W.; Jennings, B.K. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Adelaide Univ. (Australia); TRIUMF, Vancouver, British Columbia (Canada)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57832 (INIS-BR—1229, pp 89) **Pion-nucleon scattering in the cloudy bag model.** Veit, E.A.; Jennings, B.K.; Thomas, A.W. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; TRIUMF, Vancouver, British Columbia (Canada); Adelaide Univ. (Australia)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57833 (INIS-BR—1229, pp 89) **Hybrid quark models and unitary theory of pion-nucleon scattering.** Betz, M. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57834 (INIS-BR—1229, pp 91) **Lifetime of a nucleon hole state in a relativistic model.** Betz, M.; Maris, T.A.J.; Steffani, M.H. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57835 (INIS-BR—1229, pp 97) **Primeval hadron and the regge low.** Vasconcellos, C.A.Z.; Dottori, H.; Schmidt, A.A. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57836 (INIS-SU—42, pp 14-16) **Exact limit of nonperturbative three gluon vertex function in QCD/sub 3/.** Kalashnikov, O.K.; Kasado, E. (Gavanskij Univ. (Cuba)). 1987. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89780009/JAW.

Kratkie Soobshcheniya po Fizike.; (no.8).

In Experimental and theoretical physics. Collection.

Exact limit of nonperturbative three-gluon vertex function for QCD/sub 3/ in axial gauge, when all momenta are collinear to gauge vector, is defined. The obtained expression is verified by direct calculation of one-loop diagrams. 7 refs.

57837 (INIS-SU—49, pp 11-17) **Gluonium and scalar mesons.** Nagy, M.; Suyarov, V.S.; Volkov, M.K. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav; Samarkandskij Gosudarstvennyj Univ. (USSR); Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. NTIS (US Sales Only), PC A03/MF A01. Order Number DE89780012/JAW.

Preprint 5(25)-87.

In JINR rapid communications. Collection.

The inclusion of gluonia into quark model of superconductivity type is shown. The possibility of the identification of arising three isoscalar states with the scalar mesons (σ, S*, ϵ) is discussed. 9 refs.

57838 **(ITEF—189(1986)) On search for new penetrating particles.** Voloshin, M.B.; Okun', L.B.; Ellis, J. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki; European Organization for Nuclear Research, Geneva (Switzerland)). (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1986. 27p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704361/JAW.

Various hypothetic neutral particles, weakly interacting with the substance, which are predicted by different theoretical models, are considered. Experiments, in which the existence of such particles might be detected, are discussed. 72 refs.

57839 **(ITEP—211(1987)) Cluster expansion for vacuum confining fields.** Simonov, Yu.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 24p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704367/JAW.

Colored particle Green functions in vacuum background random fields are written as path integrals. Averaging over random fields is done using the cluster (cumulant) expansion. The existence of a finite correlation length for vacuum background fields is shown to produce the linear confinement, in agreement with the results, obtained with the help of averaged Hamiltonians. A modified form of cluster expansion for nonabelian fields is introduced using the path-ordered cumulants. 9 refs.

57840 **(ITEP—214(1987)) Studying (C-barS) spectroscopy in ν-barN collisions.** Asratyan, A.E.; Fedotov, A.V.; Gorichev, P.A. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704368/JAW.

Charmed strange meson neutrinoproduction is investigated. The F/sup -/(1970) antineutrino production rate is measured. Two higher (c-tildes) states are seen in the decay channels γF(2110) and D*K, respectively. 11 refs.; 4 figs.

57841 **(JINR-E—6-88-121) Meson exhange second class currents and the neutrino mass in the muon capture by light nuclei.** Kathat, C.L. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1988. 14p. NTIS (US Sales Only), PC A03. Order Number DE88015966/JAW.

Influence of the Kuboderna-Delorme-Rno model parameters ({zeta} and ξ), the scalar form factor (F/sub s/) and the muonic

neutrino rest mass (mν/sub μ/) on the asymmetry coefficient (α/sub μν/) of neutrino emission with respect to the muon spin orientation in the muon capture by light nuclei is analyzed. It is shown that the mass m/sub νμ/, the parameters {zeta} and ξ, and the form factor F/sub s/ may be estimated by studying the coefficient α/sub μν/ in O → O, Gamov-Teller, and mixed transitions, respectively. 30 refs., 4 tabs.

57842 **(JINR-R—2-87-855) Dyson-Schwinger equations of QCD and infrared behaviour of the gluonic Green functions.** Efimov, G.V.; Nedel'ko, S.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. 17p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704388/JAW.

It is shown that Dyson-Schwinger equations in the transversal gauge admit solution for ghost's and gluonic propagator in the view of entire analytical functions under certain form of exact gluon-gluon-gluon and ghost-ghost-gluon vertices. 15 refs.; 1 fig.

57843 **(LA-UR—88-2667) Are there really any experimental limits on a light Higgs boson?.** Raby, S.; West, G.B.; Hoffman, C.M. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 13p. (CONF-8809143—1). NTIS, PC A03/MF A01. Order Number DE89000394/JAW.

From Hypernuclear and low-energy kaon physics; Padova, Italy (12 Sep 1988).

The experimental evidence regarding a light Higgs boson is reviewed. It is shown that a light Higgs boson with almost any mass between 14 MeV/c^2 and 1 GeV/c^2 is still allowed by existing data. The only limit in this range comes from B decay data which, for sufficiently large values of the top quark mass, excludes a Higgs boson with a mass between 2m/sub μ/ and {approximately}700 MeV/c^2. Discussions of light Higgs boson emission in the decays of K, π, μ, {tau}, {eta}', and Γ are also given. 29 refs., 2 figs.

57844 **(LA-UR—88-2922) Parity violating total cross sections.** Goldman, T.; Preston, D. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 17p. (CONF-8806203—4). NTIS, PC A03/MF A01. Order Number DE89000378/JAW.

From Symposium on future polarization at Fermilab; Batavia, IL, USA (13 Jun 1988).

A diquark-quark scattering model for the parity-violating asymmetry in nucleon-nucleon scattering is described. Criticism of the model by Simonius and Unger is refuted. The strong energy dependence of the result, and the possibility of important non-valence contributions to the nucleon polarization, both support the need for further measurements at Fermilab and at Brookhaven energies. 9 refs., 7 figs.

57845 **(LA-UR—88-3030) Pion-exchange contribution to the parity-violating asymmetry in pp scattering.** Silbar, R.R.; Kloet, W.M.; Kisslinger, L.S.; Dubach, J. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 9p. (CONF-880983—2). NTIS, PC A02/MF A01. Order Number DE89000364/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

Charged pion exchange, producing nΔ^{++} intermediate states, contributes negatively to the weak scattering asymmetry in longitudinally-polarized pp scattering. Including this contribution moves the theoretical prediction away from the 800 MeV experimental datum. The pion-exchange contribution has both inelastic and elastic scattering components and is sizeable even below the pion production threshold. Strong distortions enhance the magnitude of the effect. 14 refs., 5 figs.

57846 **(NBI-HE—88-17) Understanding fine structure constants and three generations.** Bennett, D.L.; Picek, I.; Nielsen, H.B. (Danmarks Farmaceutiske Hoejskole, Copenhagen; Institut Rudjer Boskovic, Zagreb (Yugoslavia); Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). (Niels Bohr Inst., Copenhagen (Denmark); Institut Rudjer Boskovic, Zagreb (Yugoslavia); Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Feb 1988. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755245/JAW.

We put forward a model inspired by random dynamics that relates the smallness of the gauge coupling constants to the number of generations being 'large'. The new element in the present version of our model is the appearance of a free parameter chi that is a measure of the (presumably relatively minor) importance of a term in the plaquette action proportional to the trace in the (1/6, 2, 3) representation of the Standard Model. Calling N/sub gen/ the number of generations, the sets of allowed (N/sub gen/, chiN/sub gen/)-pairs obtained by imposing the three measured coupling constant values of the Standard Model form three lines. In addition to finding that these lines cross at a single point (as needed for a consistent fit), the intersection occurs with surprising accuracy at the integer N/sub gen/ = 3 (thereby predicting exactly three generations). It is also encouraging that the parameter chi turns out to be small and positive as expected.

57847 **(NBI-HE—88-41) Soliton of the effective chiral action.** Reinhardt, H.; Wuensch, R. (Niels Bohr Inst., Copenhagen (Denmark); Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). (Niels Bohr Inst., Copenhagen (Denmark); Niels Bohr Inst., Copenhagen (Denmark); Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Jun 1988. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755250/JAW.

The baryon number one soliton solution of the effective chiral meson action of QCD is found numerically. For this purpose the underlying fermion determinant (quark loop) is calculated in a non-perturbative way by diagonalizing the corresponding Dirac Hamiltonian. The vacuum energy is defined within a static version of the proper-time regularization. Topological soliton solutions are found for cut-offs below some critical value, above which only topologically trivial solutions exist.

57848 **Electroweak radiative corrections to tau decay.** Marciano, W.J.; Sirlin, A. (Brookhaven Natioanl Laboratory, Upton, New York 11973). *Physical Review Letters;* **61**: No. 16, 1815-1818(17 Oct 1988).

An analysis of electroweak radiative corrections to tau decays is presented. Precise predictions for leptonic and some hadronic decay rates are given. The total hadronic decay width is shown to be relatively enhanced by 2.36% due mainly to short-distance loop effects. Implications for the extraction of Λ/sub M//sub S-bar/ from the tau lifetime or leptonic branching ratios are discussed. (MS-bar denotes the modified minimal-subtraction scheme.)

57849 **QED on a circle.** Hetrick, J.E.; Hosotani, Y. (School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota 55455). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 8, 2621-2624(15 Oct 1988).

QED with massless fermions on a circle ($0 \leqq x < L$) is exactly solved. The nonintegrable phase exp[ie $\int_0$/sup L/dx $A_1(t,x)$], which is a dynamical degree of freedom on a circle, couples through the anomaly to the zero mode of the fermion-antifermion bound states, leading to the θ vacuum.

57850 **Massive fermions in the non-Abelian vortex field.** Bezerra de Mello, E.R. (Center for Theoretical Physics, Laboratory for Nuclear Science dge, Massachusetts 02139). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 8, 2616-2620(15 Oct 1988).

We obtain the electric charge of the non-Abelian vortex-fermion system using a dimensional reduction technique from (2+1)- to (1+1)-dimensional space-time. This reduction is possible if we restrict ourselves to a J = 0 (s-wave) component of the fermionic wave function. We also quantize the fermion-vortex system in the J = 0 channel, considering quantum fluctuation around the classical (background)= vortex field. We show that in this channel, the quantum Higgs fields do not interact with A/sub μ//sup q/ (nor do the fermion fields), so this sector can be decoupled and a two-dimensional fermion-Abelian gauge-field system is obtained.

57851 **Pair production of W and Z bosons and the goldstone boson equivalence theorem.** Willenbrock, S.S.D. (Physics Department, University of Wisconsin, Madison, Wisconsin 53706). *Annals of Physics (New York);* **186**: No. 1, 15-42(15 Aug 1988).

W and Z boson pairs are the signals of the production of many types of new, heavy particles, e.g., heavy Higgs bosons, new Z' bosons, heavy quark and lepton pairs, and heavy gaugino pairs. I show that the W and Z bosons which result from the decay of these heavy particles are predominantly longitudinally polarized, while those produced from background processes are primarily transversely polarized. I study W and Z boson pair production from quark-antiquark annihilation and present compact formulae for the cross sections to produce vector bosons of definite polarization. I also discuss W and Z boson pair production from gluon fusion via a virtual quark loop. Use is made throughout of the equivalence theorem, which relates the properties of longitudinally polarized vector bosons to the corresponding Goldstone bosons which are absorbed via the Higgs mechanism. I also discuss some subtleties related to the equivalence theorem which have not been previously addressed. copyright 1988 Academic Press, Inc.

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 57888, 57889

57852 **(ANL-HEP-CP—88-46) Flavor symmetry and the spin of the proton.** Lipkin, H.J. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 15p. (CONF-8806203—5). NTIS, PC A02/MF A01. Order Number DE89000522/JAW.

From Symposium on future polarization at Fermilab; Batavia, IL, USA (13 Jun 1988).

The analysis of the EMC result on the quark contribution to the spin of the proton has been challenged because of the use of SU(3) symmetry is shown not to be needed to obtain peculiar results about these quark contributions. The analysis without assuming flavor symmetry allows the quark contribution to the proton spin to be large, but only if it is due to the strange quarks, with the nonstrange quark contribution opposite to the spin of the proton. Recent data from the European Muon Collaboration have been interpreted to suggest that the spin of the proton does not come from the quarks but from the some other source. This interpretation has been questioned, both because of the errors in extrapolating to x = O and because of the use of flavor SU(3) symmetry to relate spin distributions within the proton to weak semileptonic axial vector decays of hyperons. We consider here the use of flavor symmetry. 3 refs.

57853 **(BONN-HE—88-17) Ising quantum chain with defects. Pt. 2. The so(2n) Kac Moody spectra.** Baake, M.; Chaselon, P.; Schlottmann, M. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Jul 1988. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755278/JAW.

It is shown that the spectra of the Ising quantum chain with a fixed number of defects at commensurate distances are generated by an oscillator representation of the so(2n) Kac-Moody algebra. This representation is irreducible with respect to the fermionic extension of the so(2n) Kac-Moody algebra. The corresponding algebraic structure is discussed in detail with respect to the exact solution of the Ising chain as well as to the underlying supersymmetric structure. As a by-product, the first coefficients of the finite-size expansion for the groundstate energy are given analytically.

57854 (INIS-BR—1229, pp 65) **Non-Universality of ratios of critical and tricritical parameters in the three-state Potts model with symmetry breaking perturbations.** Barbosa, M.C.B.; Theumann, W.K. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57855 (INIS-BR—1229, pp 68) **Critical and tricritical points in the three-state Potts model with symmetry-breaking perturbations.** Barbosa, M.C.B.; Theumann, W.K. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57856 (INIS-BR—1229, pp 73) **Dynamics of gauge systems and Dirac's conjecture.** Costa, M.E.V.; Girotti, H.O.; Simoes, T.J.M. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57857 (INIS-BR—1229, pp 74) **Canonical quantization of a two-dimensional model with anomalous breaking of gauge invariance.** Girotti, H.O.; Rothe, H.J.; Rothe, K.D. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Heidelberg Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57858 (INIS-BR—1229, pp 75) **Quantum dynamics of chiral fermions in a model with anomalous breaking of gauge invariance.** Girotti, H.O.; Rothe, H.J.; Rothe, K.D. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Heidelberg Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57859 **(NORDITA—87/3-P(prepr.)) Modular invariant partition function of the Ashkin-Teller model on the critical line and N=2 superconformal invariance.** Yang, S.K. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). Jan 1987. 41p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755264/JAW.

The modular invariant partition function of the two-dimentional Ashkin-Teller model on a line of continuously varying criticality is obtained. The second magnetic exponent is predicted to be 9/8. Derivation of the partition function in terms of gaussian field theories is also presented. Using chiral gaussian fields we construct the partition function for free boundary conditions, in terms of which the numerically observed spectrum is reproduced and, in particular, the appearance of N=2 supersymmetry at three particular points on the critical line is demonstrated. We discuss the fermion operator content by constructing the partition function for antiperiodic boundary conditions.

57860 **(NORDITA—87/10-P(prepr.)) Superconformal invariance in the two-dimensional Ashkin-Teller mode.** Yang, S.K.; Zheng Haibin. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Niels Bohr Inst., Copenhagen (Denmark)). (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Niels Bohr Inst., Copenhagen (Denmark)). 1987. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755265/JAW.

Superconformal invariance in the Ashkin-Teller quantum chain is studied by analyzing the finite-size limit of the spectrum with periodic or antiperiodic boundary conditions. It is shown that the spectrum at three particular points on the critical line is N = 1 supersymmetric. Operator identifications in terms of an N = 1 superconformal theory are given. N = 2 superconformal invariance in the periodic gaussian model is also discussed.

57861 **Fluctuating proton size and oscillating color transparency.** Ralston, J.P.; Pire, B. (Department of Physics and Astronomy, University of Kansas, Lawrence, Kansas 66045). *Physical Review Letters;* **61**: No. 16, 1823-1826(17 Oct 1988).

The unexpected energy dependence of high-energy fixed-angle pp elastic scattering in a nuclear target can be intrepreted in terms of interference between two perturbative QCD subprocesses. By proposing the attenuation of Landshoff-type contributions in nuclei, we obtain a parameter-free relation that matches the energy dependence of the data of Carroll et al. The approximations improve with larger A and higher energy, leading to a prediction of oscillatory energy dependence for the transparency ratio at higher energy.

6454 Field Theory

REFER ALSO TO CITATION(S) 57720, 57721, 57850, 58089

57862 **(CONF-8806236—1) Testing QCD with milli-TeV electrons.** Close, F.E. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 14p. NTIS, PC A03/MF A01. Order Number DE88017361/JAW.

From First European workshop on hadronic physics in the 1990's with multi-GeV electrons; Seillac, France (27 Jun 1988).

Analogies have been drawn between QCD where quarks build up hadrons, which in turn build up nuclei, and QED where electrons build up atoms, which in turn build up molecules. There has been a lot of talk about creating a quark theory of the nucleus in QCD by analogy with the way electrons build up molecules in QED. However, this seems to me to be a case of trying to run before you can walk, in that in QED the first step has been achieved, namely understanding atoms in terms of their electronic structure, but understanding molecules in QED is only understood in rather simple cases. In QCD the situation is even worse, in that we haven't even achieved the first step, namely in understanding how hadrons are built from quarks. We all believe that quarks are in the hadrons, and that at high momentum transfer we can apply perturbative QCD(pQCD). But to build the hadrons, we need pQCD and also non-perturbative QCD, which, at present, means building models to simulate the effects of the confinement. Insofar as any successful model of the nucleus will have it looking to a very good approximation as if it is made of nucleons, then I believe that first we have to understand the dynamics of quarks building the individual nucleons. Throughout this talk, I wanted to show how low-energy electron beams may help us deepen that understanding, and hopefully lead us towards the correct dynamical picture of the nucleon. 28 refs., 1 fig., 2 tab.

57863 **(IFVE-OTF—88-4) General form of the gauge invariant bosonic string field action for the space-time of an arbitrary dimension.** Zorin, O.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1988. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704344/JAW.

Submitted to the journal Phys. Lett. .

The general method for constructing a free gauge invariant action containing Stueckelberg fields is proposed. The method is based on nontrivial generalization of the primary BRST quantization procedure. As an ilustraration the open bosonic string model in space-time of an arbitrary dimension is considered. In this case the results obtained recently by G.B. West, are reproduced. 8 refs.

57864 (INIS-BR—1229, pp 60) **Critical exponents for 0/ sup 3/ - field models with long-range interactions.** Theumann, W.K.; Gusmao, M.A.C. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57865 (INIS-BR—1229, pp 61) **Spherical-model limit in a random field.** Theumann, W.K.; Fontanari, J.F. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57866 (INIS-BR—1229, pp 62) **Renormalization and phase transitions in Potts 0/sup 3/ - field theory with quadratic and trilinear symmetry breaking.** Barbosa, M.C.B.; Gusmao, M.A.C.; Theumann, W.K. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57867 (INIS-BR—1229, pp 63) **Quantum spin glass: a replica - symmetric theory with positive entropy.** Theumann, A. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57868 (INIS-BR—1229, pp 66) **Phase transitions in asymmetric Potts models: breakdown of the classical mean-field picture.** Gusmao, M.A.C. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57869 (INIS-BR—1229, pp 73) **Quantization of QED and QCD in a fully fixed temporal gauge.** Girotti, H.O.; Rothe, R.D. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Heidelberg Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57870 (INIS-BR—1229, pp 75) **Canonical derivation of the gluon propagator in the temporal gauge.** Girotti, H.O.; Rothe, H.J. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Heidelberg Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57871 (INIS-BR—1229, pp 76) **Operator quantization of non-Abelian gauge theories in a completely fixed axial gauge.** Simoes, T.J.M. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57872 (INIS-SU—42, pp 20-22) **One-loop continual integral in the O(2) string theory.** Marshakov, A.V. 1987. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89780009/JAW.

Kratkie Soobshcheniya po Fizike.; (no.8).

In Experimental and theoretical physics. Collection.

One-loop continual integral in the 0(2) string theory in critical dimension D=2 is calculated. Its exact correspondence to two-dimensional quantum field theory is shown. 13 refs.

57873 (INIS-SU—44/A, pp 46-48) **Gravitational field effect on the asymptotics of coupling constants in unified gauge models.** Bukhbinder, I.L.; Vologodskij, V.B.; Vol'fengaut, Yu.Yu.; Kalashnikov, O.K.; Shapiro, I.L. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780010/JAW.

Kratkie Soobshcheniya po Fizike.; (no.10).

In Experimental and theoretical physics. Collection.

Single-loop counter terms were calculated and renormgroup equations for the Yukawa and scaler coupling constants were studied for O(N) and SU(N) unified models with conformal quantum gravity. It is shown, that the account of quantum gravity keeps theory asymptotic freedom at more weak restrictions for spinor fields composition. 9 refs.; 2 tabs.

57874 **(NBI-HE—88-14) Resummation of the 1/N-expansion of the non-linear σ-model by Dyson-Schwinger equations.** Drouffe, J.M.; Flyvbjerg, H. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique). (Niels Bohr Inst., Copenhagen (Denmark); CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique). Feb 1988. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755243/JAW.

Dyson-Schwinger equations for the O(N)-symmetric nonlinear σ-model are derived and expanded in 1/N. A closed set of equations is obtained by keeping only the leading term and the first correction term in this expansion. These equations are solved numerically in 2 dimensions on square lattices of sizes 50x50 and 100x100. Results for the magnetic susceptibility and the mass gap are compared with predictions of the ordinary 1/N-expansion and with Monte Carlo results. The results obtained with the Dyson-Schwinger equations show the same scaling behavior as found in the Monte Carlo results. This is not the behavior predicted by the perturbative renormalization group.

57875 **(NBI-HE—88-24) O(N)-symmetric σ-model on finite lattice: Perturbation theory vs. resummed 1/N-expansion.** Flyvbjerg, H. (Niels Bohr Inst., Copenhagen (Denmark)). 1988. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755196/JAW.

Dyson-Schwinger equations exact to O(1/N) are solved perturbatively at weak coupling for the two-point function of the O(N)-symmetric non-linear σ-model on a finite lattice. The solution equals the known second order weak coupling result to all powers in 1/N (third and higher powers have coefficient zero). In the Dyson-Schwinger equations zero momentum modes cause no problems. On the contrary, their dominance is the basis for a simple expansion scheme.

57876 **(NBI-HE—88-29) Covariant super reggeon calculus for superstrings.** Petersen, J.L.; Sidenius, J.R.; Tollsten, A.K. (Niels Bohr Inst., Copenhagen (Denmark); Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). (Niels Bohr Inst., Copenhagen (Denmark); Niels Bohr Inst., Copenhagen (Denmark); Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). Jul 1988. 49p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755247/JAW.

A previously developed formalism for the bosonic string is extended to the Neveu-Schwarz-Ramond string using 2-d superspace techniques throughout. 3-string vertices for NS- and R-strings are constructed, sewing rules developed, and the technique of quasi-superconformal modes is set up for constructing the measure on super moduli space. Symmetries, such as superconformal invariance and BRST-invariance, are guaranteed ab initio. Picture changing and bosonization are avoided. Examples are given. The formalism should allow a superstring loop calculus based on supermoduli. Results concerning the ensuing super-Schottky description are given.

57877 **(NBI-HE—88-30) Covariant loop calculus for the Neveu-Schwarz string.** Petersen, J.L.; Sidenius, J.R.; Tollsten, A.K. (Niels Bohr Inst., Copenhagen (Denmark); Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). (Niels Bohr Inst., Copenhagen (Denmark); Niels Bohr Inst., Copenhagen (Denmark); Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). May 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755199/JAW.

We derive the g-loop, N-string amplitude (density) of the (closed) NS-string in an explicit parametrization of super moduli space for a subset of 2/sup g/ even spinstructures.

57878 **(NBI-HE—88-40) Note on multi-loop vertices in string theory.** Petersen, J.L.; Sidenius, J.R.; Tollsten, A.K. (Niels Bohr Inst., Copenhagen (Denmark); Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). (Niels Bohr Inst., Copenhagen (Denmark); Niels Bohr Inst., Copenhagen (Denmark); Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). Jun 1988. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755249/JAW.

We carry out a comparison between vertices proposed by various authors by discussing the multi-loop vertices for the bosonic string and for the NS-string in terms of oscillator modes.

57879 **(NBI-HE—88-42) Summing Feynman graphs by Monte-Carlo: Planar phi/sup 3/-theory and dynamically triangulated random surfaces.** Boulatov, D.V.; Kazakov, V.A. (AN SSSR, Moscow. Cybernetics Council; Niels Bohr Inst., Copenhagen (Denmark); AN SSSR, Moscow. Cybernetics Council). (Niels Bohr Inst., Copenhagen (Denmark); Niels Bohr Inst., Copenhagen (Denmark)). Jun 1988. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755251/JAW.

New combinatorial identities are suggested relating the ratio of (n-1)-th and n-th orders of (planar) perturbation expansion for any quantity to some average over the ensemble of all planar graphs of the n-th order. These identities are used for Monte-Carlo calculation of critical exponents γ/sub str/ (string susceptibility) in planar phi/sup 3/-theory and in the dynamically triangulated random surface (DTRS) model near the convergence circle for various dimensions. In the solvable case D = 1 the exact critical properties of the theory are reproduced numerically.

57880 **(NBI-HE—88-44) Percolation on a fractal with the statistics of planar Feynman graphs: Exact solution.** Kazakov, V.K. (Niels Bohr Inst., Copenhagen (Denmark); AN SSSR, Moscow. Cybernetics Council). (Niels Bohr Inst., Copenhagen (Denmark); Niels Bohr Inst., Copenhagen (Denmark)). Jul 1988. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755252/JAW.

A new bond-percolation problem on a graph (fractal) randomly chosen from all planar Feynman graphs of zero-dimensional phi/sup 3/ (or phi/sup 4/) theory in the thermodynamical limit (infinite order of graphs) is solved exactly. At the percolation transition point p/sub c/ the mean number of clusters per volume unit has the singularity (p/sub c/-p)/sup 4/log(p/sub c/-p) which corresponds to the critical exponent α=1-2. (orig./HSI).

57881 **(NBI-HE—88-45) Anti-screening of large magnetic fields by vector bosons.** Ambjoern, J.; Olesen, P. (Niels Bohr Inst., Copenhagen (Denmark)). Jun 1988. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755253/JAW.

In the SO(3) model with massive vector bosons we show that for magnetic fields exceeding m/sub W//sup 2//e there is condensation of W's. This condensation is characterized by anti-screening. Near the critical field we show that the condensate is a lattice of vortex lines.

57882 **(NBI-HE—88-49) Type I superstrings in dimensions less than ten. Pt. 2. Finiteness.** Bern, Z.; Dunbar, D.C. (Niels Bohr Inst., Copenhagen (Denmark); Royal Holloway and Bedford New Coll., Englefield Green (UK). Dept. of Physics). (Niels Bohr Inst., Copenhagen (Denmark); Niels Bohr Inst., Copenhagen (Denmark)). Jun 1988. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755254/JAW.

One-loop finiteness is studied in new open superstring constructions in D < 10. We show that in D = 2,5 the dilaton tadpole singularity cancels for a number of models with an appropriate choice of Chan-Paton gauge group. In other dimensions, cancellation of the dilaton singularity is not found within this construction.

57883 **(NBI-HE—88-51) Duality in the U(1) Higgs model with an external field.** Damgaard, P.H. (Niels Bohr Inst., Copenhagen (Denmark)). Jul 1988. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755255/JAW.

An external electromagnetic field is coupled to the lattice U(1) Higgs model in a Villain form. Duality transformations are then used to express the partition function in terms of an effective Lagrangian of topological excitations and their couplings to the external field. Consequences for the phase diagram are derived.

57884 **(NORDITA—87/13-P(prepr.)) Scaling the string tension in a new class of regularized string theories.** Ambjoern, J.; Durhuus, B.; Jonsson, T. (Niels Bohr Inst., Copenhagen (Denmark); Copenhagen Univ. (Denmark). Matematisk Inst.). (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Niels Bohr Inst., Copenhagen (Denmark)). 1987. 18p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755266/JAW.

We consider two models of discretized string theories with an action which depends on the extrinsic curvature and prove that the string tension vanishes as the coupling strength of the extrinsic curvature tends to infinity. We discuss the physical properties of the models and argue that they possess a nontrivial scaling limit.

57885 **(NORDITA—88/17-P(prepr.)) G/sub N/ x G/sub L//G/sub N+L/ conformal field theories and their modular invariant partition functions.** Christe, P.; Ravanini, F. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). Apr 1988. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755201/JAW.

We study a Feigin-Fuchs construction of conformal field theories based on a GxG/G coset space, in terms of screened bosons and parafermions. This allows to get the formula for the conformal dimensions of primary operators. Lists of modular invariant partition functions for the SU(3), SO(5) and G/sub 2/ Wess-Zumino-Witten models are given. Besides the principal series of diagonal invariants, a complementary series exists for SU(3) and SO(5), which is due to the outer automorphism of the Kac-Moody algebra. Moreover, exceptional solutions appear at level 5, 9, 21 for SU(3), at level 3, 7, 12 for SO(5) and at level 3, 4 for G/sub 2/. From these modular invariants, those for the corresponding G/sub N/ x G/sub L//G/sub N+L/ models are constructed.

57886 **(NORDITA—88/19-P(prepr.)) N-string, g-loop vertex for the fermionic string.** Di Vecchia, P.; Hornfeck, K.; Frau, M.; Lerda, A.; Sciuto, S. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Istituto Nazionale di Fisica Nucleare, Turin (Italy); Niels Bohr Inst., Copenhagen (Denmark); State Univ. of New York, Stony Brook (USA). Inst. for Theoretical Physics; Naples Univ. (Italy). Dipt. di Scienze Fisiche; Istituto Nazionale di Fisica Nucleare, Naples (Italy)). (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Istituto Nazionale di Fisica Nucleare, Turin (Italy); Niels Bohr Inst., Copenhagen (Denmark); State Univ. of New York, Stony Brook (USA). Inst. for Theoretical Physics; Istituto Nazionale di Fisica Nucleare, Naples (Italy)). 1988. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755202/JAW.

We construct a N-String, g-loop Vertex for the fermionic string, that is the supersymmetric extension of the analogous bosonic Vertex. As a byproduct we obtain also the g-vacuum for the fermionic string.

57887 **(NORDITA—88/24-P(prepr.)) G-loop vertices for free fermions and bosons.** Pezzella, F. (International School for Advanced Studies, Trieste (Italy); Istituto Nazionale di Fisica Nucleare, Trieste (Italy)). (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); International School of Advanced Studies, Trieste (Italy); Istituto Nazionale di Fisica Nucleare, Trieste (Italy)). May 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755268/JAW.

We construct a g-loop vertex for fermions in terms of the Szegoe kernel and we study its connections with the g-vacuum, that is the starting point for the computation of multiloop amplitudes in a recently developed operator formalism on arbitrary Riemann surfaces. The same construction is then performed for the free bosonic theory, checking bosonization of the free fermionic theory on an arbitrary Riemann surface.

57888 **Anomalous congruences.** Braden, H.W. (Institute of Field Physics, Department of Physics and Astronomy, and Department of Mathematics, University of North Carolina, Chapel Hill, North Carolina 27514). *Journal of Mathematical Physics (New York);* **29**: No. 11, 2494-2498(Nov 1988).

Congruences between different Chern classes and hence anomaly coefficients are observed. These are determined in general for SU(n) vector bundles over spheres. The results are of use in calculating global anomaly freedom for gauge theories as well as other index theory calculations.

57889 **Coherent-state path-integral S-matrix formalism applied to the Lee model.** Hammer, C.L.; Shrauner, J.E. (Ames Laboratory and the Department of Physics, Iowa State University, Ames, Iowa 50011). *Journal of Mathematical Physics (New York);* **29**: No. 11, 2507-2512(Nov 1988).

In this paper we show that a coherent-state path-integral treatment significantly simplifies the analysis of the Lee model, including higher sector calculations. The method may be applicable to more general field theories. However, the special properties of the Lee model allow the results to be displayed in closed form.

57890 **Renormalization of O(N) nonlinear σ model on a p-adic field.** Okada, Y.; Ubriaco, M.R. (Institute of Field Physics, Department of Physics and Astronomy, University of North Carolina, Chapel Hill, North Carolina 27599-3255). *Physical Review Letters;* **61**: No. 17, 1910-1913(24 Oct 1988).

A renormalizable and asymptotically free O(N) nonlinear σ model is defined on a p-adic field. The effective potential is computed to the leading order in the 1/N expansion and it is shown that the mass term for the O(N) vector field is generated dynamically and the full O(N) symmetry is realized linearly. Also a discrete scale invariance of the classical action is shown to be violated because of quantum effects.

57891 **Stochastic inflation and superstring models.** Graziani, F.R.; Olive, K.A. (School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota 55455). *Physical Review [Section] D: Particles and Fields;* **38**: No. 8, 2386-2391(15 Oct 1988).

Stochastic processes are capable of producing an inflationary epoch using potentials which typically do not inflate (e.g., potentials with large positive-mass terms). We consider a simple model which in the context of no-scale supergravity inflates but in the context of superstring theory does not. Stochastic processes again allow for the possibility of inflation provided initial scalar-field fluctuations are large enough.

57892 **Feynman rules for the δ expansion.** Pinsky, S.S.; Simmons L.M. Jr. (Department of Physics, University of Arizona, Tucson, Arizona 85721). *Physical Review [Section] D: Particles and Fields;* **38**: No. 8, 2518-2525(15 Oct 1988).

In this paper we further develop a novel perturbation scheme for quantum field theory in which the form of the interaction is expanded about the free theory. A set of Feynman rules for the perturbation expansion is derived that does not require the introduction of the provisional Lagrangian used in earlier papers. The rules permit direct calculation to all orders in the δ expansion, and are almost identical to standard Feynman rules. Only the form of the propagator and the vertex function are changed.

57893 **New nonperturbative calculation: Renormalization and the triviality of $(\lambda phi^4)_4$ field theory.** Bender, C.M.; Jones, H.F. (Department of Physics, Washington University, St. Louis, Missouri 63130). *Physical Review [Section] D: Particles and Fields;* **38**: No. 8, 2526-2529(15 Oct 1988).

Using a recently proposed perturbation scheme we examine a $\lambda(phi^2)/sup\ 1+//sup\ \delta/$ self-interacting scalar-field theory in d-

dimensional space-time. We compute the two-point and four-point Green's functions to second order in powers of δ. First, we carry out the renormalization program to leading order in powers of δ. We obtain a nontrivial field theory for d<4. On the other hand, our analysis suggests strongly that when d>4 the theory is free. The situation remains essentially unchanged to second order in powers of δ.

57894 **Chiral anomalies and point-splitting regularization.** Qiu, Z.; Ren, H. (The Center of Theoretical Physics, Chinese Center of Advanced Science emia Technology, Beijing, China). *Physical Review [Section] D: Particles and Fields;* **38**: No. 8, 2530-2536(15 Oct 1988).

The anomalies of chiral gauge theories are discussed from the point of view of point-splitting regularization. The integrability of the regularized current is examined. Its relations with the Wess-Zumino consistency condition and Bose symmetry of the regularized Feynman diagrams are discussed. A point-splitting regularization scheme of the action is proposed as an alternative way to calculate the consistent anomalies.

57895 **Constraints on covariant theories for closed string fields.** Zwiebach, B. (Center for Theoretical Physics, Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Annals of Physics (New York);* **186**: No. 1, 111-140(15 Aug 1988).

Assuming essential light-cone features persist in covariant closed string field theory a set of constraints is discussed. The contracted three-point vertex must generate all inequivalent tori. This leads to a well-defined mathematical problem. If the full theory is to be just cubic a Jacobi identity should be satisfied by the vertex. It is shown in generality that SL(2, C)-type vertices cannot satisfy either requirement, even though they can generate regions reminiscent to the fundamental domain of the modular group. copyright 1988 Academic Press, Inc.

57896 **Spectrum-generating groups program and the string.** Ne'eman, Y. (Tel Aviv Univ., (Israel)). *Foundations of Physics;* **18**: No. 3, 245-275(Mar 1988). Contract FG05-85ER40200.

Schroedinger's approach was analytical, but it is equivalent to an algebraic treatment. We review the evolution of group theory as a physical tool and its application to the Hilbert space of Schroedinger's eigenstates. Special emphasis is put on recent results relating to the relativistic quantized string.

57897 **Families of Bose rays in quantum optics.** Mukunda, N.; Sudarshan, E.C.G.; Simon, R. (Indian Institute of Science, Bangalore). *Foundations of Physics;* **18**: No. 3, 277-306(Mar 1988). Contract FG05-85ER40200.

Having known classical wave optics and wave mechanics, can we reverse Schroedinger's path and extend the concept of families of rays of light to provide a new exact rendering of quantum optics including the Bose nature of photons? This question is answered in the affirmative, and the implications of the Bose symmetry for certain nonlocal correlations of the many-ray distribution functions are worked out. The similarities and the differences between classical and quantum wave optics are brought out. The ray-ray Bose correlation is analyzed. The generating functional for the many-ray distribution functions is formulated; and the notion of paraxial illumination for quantum optics is made precise.

65 PHYSICS II

REFER ALSO TO CITATION(S) 57667, 57668

57898 **(INIS-mf—11308) Institute for Theoretical Physics: Progress report 1986/87 (October 1986 - September 1987).** Pilch, M. (comp.). (Graz Univ. (Austria). Inst. fuer Theoretische Physik). Dec 1987. 17p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704028/JAW.

The research projects in the fields: electromagnetic processes, quantum mechanics and field theory, elementary particle physics, mathematical physics, many-body physics and nuclear physics, semiconductor physics, energy and foundations of nuclear energetics are given in titles only. There is additionally a list of publications, preprints, submitted papers, lectures, by institute staff members, and theses. (qui).

57899 **(INIS-SU—49) JINR rapid communications. Collection.** (Joint Inst. for Nuclear Research, Dubna (USSR)). 1987. 47p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89780012/JAW.

The paper in this journal have been abstracted and indexed separately.

6510 Nuclear Physics

57900 **(CONF-8809156—1) Extended covariance data formats for the ENDF/B-VI differential data evaluation.** Peelle, R.W.; Muir, D.W. (Oak Ridge National Lab., TN (USA); Los Alamos National Lab., NM (USA)). 1988. Contract AC05-84OR21400;W-7405-ENG-36. 10p. NTIS, PC A02/MF A01. Order Number DE89000649/JAW.

From Specialists' meeting on the application of critical experiments and operating data to core design via formal methods of cross section data adjustment; Jackson Hole, WY, USA (23 Sep 1988).

The ENDF/B-V included cross section covariance data, but covariances could not be encoded for all the important data types. New ENDF-6 covariance formats are outlined including those for cross-file (MF) covariances, resonance parameters over the whole range, and secondary energy and angle distributions. One "late entry" format encodes covariance data for cross sections that are output from model or fitting codes in terms of the model parameter covariance matrix and the tabulated derivatives of cross sections with respect to the model parameters. Another new format yields multigroup cross section variances that increase as the group width decreases. When evaluators use the new formats, the files can be processed and used for improved uncertainty propagation and data combination. 22 refs.

57901 (IAEA-TECDOC—457, pp 89-96) **Systematics of 14 MeV neutron induced reaction cross-sections.** Qaim, S.M. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemie 1 - Nuklearchemie). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

The relative contributions of 14 MeV neutron induced nuclear reaction cross sections for medium and heavy mass nuclei are outlined and some of the systematic trends observed in the data are reviewed. The systematics of the common reactions like (n,p), (n,α) and (n,2n) are well known; they are treated here only briefly. Special attention is paid to less common and rare reactions like (n,d), (n,n'p), (n,nα), (n,t) and (n,/sup 3/He) for which the data base has improved in recent years and analysis of systematic trends is now more reliable. (author). 46 refs, 10 figs.

57902 (IAEA-TECDOC—457, pp 97-112) **Status of experimental and theoretical gamma ray emission spectra.** Oblozinsky, P. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

Reviewed are recent developments in experimental and theoretical γ ray emission spectra for fusion reactor technology. We concentrate on (n,xγ) reactions at E/sub n/ approx.= 0.1-20 MeV, and on the progress achieved after the previous IAEA Advisory Group Meeting held in 1978. (author). 80 refs, 11 figs, 4 tabs.

57903 (IAEA-TECDOC—457, pp 113-124) **Status of experimental and theoretical double-differential neutron emission data.** Seeliger, D. (Technische Univ., Dresden (German Democratic Republic)). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

The present status of double-differential neutron emission cross section (DDNECS) data for fusion reactor applications is analyzed briefly. First, the request for and availability of DDNECS for fusion reactor purposes is considered. In the following sections, the status for continuous DDNECS at 14 MeV incident energy and below as well as for cross sections of isolated levels will be analyzed for selected nuclei. Finally, a few recommendations concerning the further work in this field are formulated. (author). 37 refs, 14 figs, 1 tab.

57904 (IAEA-TECDOC—457, pp 125-127) **Report on the IAEA co-ordinated research programme on measurement and analysis of 14 MeV neutron nuclear data needed for fission and fusion reactor technology.** Mehta, M.K. (Bhabha Atomic Research Centre, Bombay (India)). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

The Nuclear Data Section of the IAEA implemented a Co-ordinated Research Programme (CRP) during the period 1982-85 on measurement and analysis of neutron nuclear data needed for fission and fusion reactor technology with the objectives of improving the status of 14 MeV neutron data and to bring about transfer of technology of fast neutron cross section measurements to a few laboratories in the developing countries. The paper describes the operational aspects of the CRP in general, the working, implementation and co-ordination of the programmes between the participating laboratories and summarises the conclusions, results and recommendations arising out of the full implementation of this programme. The results indicated that the status of 14 MeV neutron data is considerably improved with a need for more measurements for double differential neutron emission spectra, some specific activation measurement for products of isomeric States and certain long life activities.

57905 (IAEA-TECDOC—457, pp 127-136) **Excitation of isomeric states in (n,n') reactions.** Vonach, H. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Radiumforschung und Kernphysik). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

The present status of our knowledge on activation cross-sections for metastable nuclear states by (n,n') reactions is reviewed and summarized. Though the emphasis is given to the cross-sections for 14 MeV neutrons, the neutron dependence of these cross-sections is also discussed briefly. Both the status of experimental data and the possibilities of theoretical calculations of (n,n') cross-sections are addressed and a new systematic of (n,n') cross-sections for isomer production at E/sub n/ {similar←to} 14 MeV is presented. Some striking discrepancies between the existing measurements and theoretical expectations are identified and possibilities for improved measurements are discussed. (author). 42 refs, 4 figs, 3 tabs.

57906 (IAEA-TECDOC—457, pp 144-150) **Standard cross-sections for fusion.** Conde, H. (Uppsala Univ. (Sweden). Gustaf Werner Inst.). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

The status of neutron cross section standards in the energy region 1 to 20 MeV is presented. Potential use of secondary reference cross sections and standard cross sections above 20 MeV is also discussed. Recommendations are given to improvements of the standard data base for fusion related cross section measurements. (author). 31 refs, 5 figs.

57907 (INIS-SU—41, pp 59-60) **Orientation effects in small-energy secondary particle yield.** Antipenko, A.P.; Bel'kovets, V.A.; Kasilov, V.I.; Rudenko, V.T.; Shcherbak, S.F. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780008/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 2(40).

In Radiation-induced damage physics and material technology. Scientific-technical collection.

An increase of neutron yield from oriented tungsten monocrystal, through which 36 MeV energy accelerated electron beam passed, is detected, which is obviously condidtioned by an increase of nucleus-active photons in a monocrystal atomic chain. 5 refs.; 2 figs.

57908 **(JINR-E—1-87-398) Charged particle spectra in π/sup -/p,π/sup -/d and π/sup -/C interactions at 38 GeV/c with single-particle high p/sub T/ trigger.** Boos, E.G.; Mosienko, A.M.; Baerwolff, H. and others. (AN Kazakhskoj SSR, Alma-Ata. Inst. Fiziki Vysokikh Ehnergij; Akademie der Wissenschaften der DDR, Berlin-Zeuthen. Inst. fuer Hochenergiephysik). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1987. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704378/JAW.

Submitted to the Europhysics on High Energy Physics, Sweden, Uppsala, 1987.

Angular momentum distributions of charged secondaries from 38 GeV/c π/sup -/p, π/sup -/d and π/sup -/C interactions triggered on at least one particle with p/sub T/ >or approx. 1 GeV/c at an 90 deg πN c.m.s angle have been investigated with the spectrometer RISK (a streamer chamber placed into a magnet). Transversal momentum spectra of secondaries in the 0.4-2.4 GeV/c p/sub T/-range including triggering particles are quite well fitted with the exponential function for all nuclei studied and for particles of different charges. The azimuthal angle distribution of secondaries (an angle relative to the p/sub T/-tilde of the triggering particle) for both trigger-like and trigger-unlike charges is anisotropic, preferring the direction away from the triggering particle. The mean charge distribution of associated particles is discussed. A small fraction of triggering particles is due to neutral strange particle decays. Many Λ/sup 0/-hyperons were detected among those neutral strange triggers. 7 refs.; 3 refs.; 6 tabs.

57909 **(JINR-R—1-87-631) Some peculiarities of lateral flux of particles in neon 22 collisions with nuclei in photoemulsion at 4.1 A GeV/c momentum.** Bannik, B.P.; Tolstov, K.D.; Ehl'-Nagi, A. and others. (Joint Inst. for Nuclear Research, Dubna (USSR); Cairo Univ. (Egypt)). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 15p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704382/JAW.

Submitted to the journal J. Phys. .

Analysis of emission of projectile and target fragments in / sup 22/Ne+Ag, Br collisions at 4.1 A GeV/c is carried out to study peculiarities of particle "lateral fluxes". The possibility of determining reaction plane is used. Recoils of /sup 22/Ne projectile fragments are observed by investigating their projections on the reaction plane. Angular distribution of slow fragments has a maximum, which is due to lateral ejection. Studying projections of fragments on the azimuthal plane, data on recoils are obtained. Increase of residual ranges is observed for slow fragments emitted in the direction of the lateral ejection. 20 refs.; 8 figs.; 3 tabs.

57910 **(LA-UR—88-3104) The status of ENDF/B-VI.** Roussin, R.; Dunford, C.; McKnight, R.; Young, P. (Oak Ridge National Lab., TN (USA); Brookhaven National Lab., Upton, NY (USA); Argonne National Lab., IL (USA); Los Alamos National Lab., NM (USA)). 1988. Contract AC05-84OR21400;W-31109-ENG-38;AC02-76CH00016;W-7405-ENG-36. 10p. (CONF-880906—8). NTIS, PC A03/MF A01. Order Number DE88016793/JAW.

From 7. international conference on radiation shielding; Bournemouth, UK (12 Sep 1988).

A new version of the United States evaluated nuclear data file, ENDF/B-VI, is presently under development. Major emphasis is being placed on correcting some long-standing nuclear data problems that adversely affect applied calculations for both fission and fusion reactors. The paper reviews modifications to the formats and utility codes, outlines the evaluation activities, discusses the data testing programs, and projects a date for the unrestricted release of the new library. 27 refs., 2 tabs.

57911 **(UCRL—98975) The all particle method: Coupled neutron, photon, electron, charged particle Monte Carlo calculations.** Cullen, D.E.; Perkins, S.T.; Plechaty, E.F.; Rathkopf, J.A. (Lawrence Livermore National Lab., CA (USA)). Jun 1988. Contract W-7405-ENG-48. 10p. (CONF-880906—10). NTIS, PC A03/MF A01. Order Number DE88016170/JAW.

From 7. international conference on radiation shielding; Bournemouth, UK (12 Sep 1988).

At the present time a Monte Carlo transport computer code is being designed and implemented at Lawrence Livermore National Laboratory to include the transport of: neutrons, photons, electrons and light charged particles as well as the coupling between all species of particles, e.g., photon induced electron emission. Since this code is being designed to handle all particles this approach is called the "All Particle Method". The code is designed as a test bed code to include as many different methods as possible (e.g., electron single or multiple scattering) and will be data driven to minimize the number of methods and models "hard wired" into the code. This approach will allow changes in the Livermore nuclear and atomic data bases, used to described the interaction and production of particles, to be used to directly control the execution of the program. In addition this approach will allow the code to be used at various levels of complexity to balance computer running time against the accuracy requirements of specific applications. This paper describes the current design philosophy and status of the code. Since the treatment of neutrons and photons used by the All Particle Method code is more or less conventional, emphasis in this paper is placed on the treatment of electron, and to a lesser degree charged particle, transport. An example is presented in order to illustrate an application in which the ability to accurately transport electrons is important. 21 refs., 1 fig.

57912 **(WHC-SA—0264) Status of dosimetry and activation data.** Mann, F.M. (Westinghouse Hanford Co., Richland, WA (USA)). Nov 1987. Contract AC06-87RL10930. 16p. (CONF-880546—35). NTIS, PC A03/MF A01. Order Number DE89000638/JAW.

From International conference on nuclear data for science and technology; Mito, Japan (30 May 1988).

The need for and the status of dosimetry and activation nuclear data libraries will be presented. Each of the major library systems in the world will be covered. Besides the traditional long-lived fission reactor dosimetry sets, new dosimetry sets containing short-lived products needed for fusion applications will be discussed. A major segment of the talk will deal with activation, especially the needs of fusion. The recent Dutch, United Kingdom, and United States of America collaboration will be presented in detail. 12 refs.

6511 Experimental Techniques

REFER ALSO TO CITATION(S) 57806

6512 Nuclear Properties And Reactions, A=1-5, Experimental

57913 **(JINR-E—1-87-797) Δ-isobar excitations of nuclei in charge-exchange reactions.** Ableev, V.G.; Eliseev, S.M.; Inozemtsev, V.I. and others. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704379/JAW.

Submitted to the Intern. Symp. Modern Developments Nucl. Phys. .

Measurement results of differential cross sections of the (/ sup 3/He, t) charge-exchange on carbon nuclei and protons at energies from 800 MeV/nucleon up to 5 GeV/nucleon are presented. It is shown that the reaction on a nucleus proceeds mainly through the excitation of the δ isobars; the process is not reduced to the quasi-free production of the δ isobar on an individual internuclear nucleon with a subsequent free motion of the isobar through the nucleus. The collective effects caused by other nucleons of a target nucleus are important. This conclusion is confirmed by analysis of the information on the nuclear δ excitations in the charge-exchange reactions of relativistic nuclei and A(p, n) reaction. A possible connection between the discussed effects and those observed in pion-nucleus studies, in particular, with the energy dependence of the πA cross sections is noted. 20 refs.; 14 figs.; 1 tab.

57914 **(JINR-R—1-87-849) Study on inclusive characteristics of d-bard interactions at 12GeV/c.** Batyunya, B.V.; Boguslavskij, I.V.; Bruntsko, D. and others. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704384/JAW.

The inclusive characteristics of the d-bard-interactions at 12 GeV/c are studied. The p/sub T//sup 2/-distributions of all negative and positive particles, as well as the p/sub T//sup 2/,x and y/sup */-distributions of π/sup -/-mesons and antibaryons are demonstrated. In order to study multiscattering processes in d-bard-interactions the obtained characteristics are compared with the corresponding ones in N-barN-processes at 6.1 GeV/c. At best the existence of the multiscattering processes in the invariant x-distributions of the π/sup +-/-mesons from d-bard-interactions is manifested. 15 refs.; 4 figs.; 2 tabs.

57915 **(LA—11417-T) Inclusive pion double charge exchange in ^{4}He at intermediate energies.** Kinney, E.R. (Los Alamos National Lab., NM (USA)). Oct 1988. Contract W-7405-ENG-36. 347p. The Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA 02139. Order Number TI89001457/JAW.

Thesis. Submitted to Massachusetts Inst. of Tech., Cambridge.

A systematic experimental study of inclusive pion double charge exchange in ^{4}He has been undertaken. The reaction ^{4}He(π$^+$,π/sup {minus}/4p was observed at incident energies 120, 150, 180, 210, 240, and 270 MeV; the ^{4}He(π/sup {minus}/,π$^+$)4n reaction was observed only at incident energies 180 and 240 MeV. At each incident energy, the doubly differential cross section was measured at three to five angles between 25{degree} and 130{degree} over the entire range of outgoing pion energies from 10 MeV up to the kinematic limit for the reaction in which the final state consists of the oppositely charged pion plus four free nucleons. The spectra of outgoing pions are strikingly different from those observed for the inclusive double charge exchange reaction in heavier nuclei. The forward-angle spectra from both the reactions in ^{4}He exhibit a prominent peak at high outgoing pion energies. Interpretation of the peak as a four-nucleon resonance is ruled out by kinematic analysis. The results of a calculation, wherein the double charge exchange reaction is assumed to consist of two sequential single charge exchange interactions, are also presented and suggest that the high energy peak is naturally explained by this double scattering reaction mechanism. In spite of the qualitative success of the calculation, the double charge exchange reaction and its relation to other pion-nucleus processes is still not quantitatively understood. A large set of non-charge exchange and double charge exchange data with small relative uncertainty is now available for comparison to theoretical predictions. 152 refs., 123 figs., 11 tabs.

57916 **Longitudinal response functions and sum rules for quasielastic electron scattering from ^{3}H and ^{3}He.** Dow, K.; Dytman, S.; Beck, D.; Bernstein, A.; Blomqvist, I.; Caplan, H.; Day, D.; Deady, M.; Demos, P.; Dodge, W.; and others. (Physics Department and Bates Linear Accelerator Center, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physical Review Letters;* **61**: No. 15, 1706-1709(10 Oct 1988).

Longitudinal response functions for ^{3}H and ^{3}He have been obtained from inclusive electron scattering cross sections, for 200≦q≦550 MeV/c. The response functions are compared with several theoretical calculations, all of which use exact three-body

ground-state wave functions. The response functions are found to be more similar than the calculations predict. When a direct calculation of the Coulomb sum rule is compared with our data, the agreement is good and evidence for two-proton correlations in ^{3}He is clear.

6513 Nuclear Properties And Reactions, A=6-19, Experimental

57917 (IAEA-TECDOC—457, pp 136-144) **Neutron angular distribution from /sup 7/Li.** Liskien, H. (Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

Status of knowledge of the angular distribution of emitted neutrons after the interaction of primary neutrons with the breeder material /sup 7/Li is presented. Experimental methods as well as nuclear model calculations of (double-) differential neutron emission cross sections are overviewed. (author). 19 refs, 4 figs, 2 tabs.

57918 (JINR-E—15-87-733) **Study of He isotopes with A≧5 in heavy ion reactions at E/A∼10 MeV/nucleon.** Belozerov, A.V.; Borcea, C.; Dlouhy, Z.; Kalinin, A.M.; Nguyen Hoai Chau; Penionzhkevich, Yu.E. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1987. 18p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704381/JAW.

Submitted to the journal Nucl. Phys., A.

Heavy He isotopes are studied by measuring the energy spectra of their stable partners in the exit channel of different two-body direct reactions: /sup 9/Be+/sup 9/Be, /sup 11/B+/sup 7/Li, /sup 11/B+/sup 9/Be and /sup 14/C+/sup 9/Be. The population cross sections for ground and excited states have been measured and the widths of nucleon unstable states have been extracted. New excited states. 14 refs.; 11 figs.; 3 tabs.

57919 (KIYI—87-5) **Study on the /sup 12/C(α,α/sup '/)/sup 12/C/sup */(α)/sup 8/Be reaction mechanism at E/sub α/=27.2 MeV.** Kozyr', Yu.E. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1987. 23p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704398/JAW.

Angular correlations of products of /sup 12/C(α, α)/sup 12/C/sup */(α)/sup 8/Be by means of successive type reaction resonance 9.641(3/sup -/) of intermediate nucleus /sup 12/C were measured in kinematically complete experiment. A complete angular correlation function for complanar geometry is found at six exit angles of a first particle: 20 deg, 30 deg, 40 deg, 50 deg, 60 deg, 70 deg (laboratory system). A compound-nucleus mechanism of the first stage of reaction describes the experimental results if the reaction runs through the states σ/sup +/ of compound nucleus /sup 16/O. The possibility of addition of direct mechanism is estimated less than 20% cross section. 15 refs.; 3 figs.; 1 tab.

57920 (LA-UR—88-2924) **The empirical connection between (p,n) cross sections and beta decay transition strengths.** Taddeucci, T.N. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 17p. (CONF-880386—10). NTIS, PC A03/MF A01. Order Number DE89000376/JAW.

From International conference on spin-observables in nuclear physics; Telluride, CO, USA (14 Mar 1988).

A proportionality is assumed to exist between 0{degree} (p,n) cross sections and the corresponding beta decay transition strengths. The validity of this assumption is tested by comparison of measured (p,n) cross sections and analogous beta decay strengths. Distorted waves impulse approximation calculations also provide useful estimates of the accuracy of the proportionality relationship. 14 refs., 10 figs.

6514 Nuclear Properties And Reactions, A=20-38, Experimental

57921 (BNL-NCS—41752) **Theoretical calculation of medium-energy proton-induced reactions on Al, Zr, and Pb.** Ramavataram, S.; Divadeenam, M.; Ward, T.E. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 11p. (CONF-8805203—1). NTIS, PC A03/MF A01. Order Number DE89001318/JAW.

From Theoretical calculation of medium-energy proton-induced reactions on Al, Zr, and Pb; Mito, Japan (18 May 1988).

The intranuclear cascade model of nuclear reactions was used to calculate double differential cross sections for the (p,xn) reaction. The calculations were performed with a generalized version of the code VEGAS, CLUST. Model predictions are compared with recent experimental data. Calculated fast-particle spectral shapes at low angles are reproduced reasonably well for the experimental data. As one possible improvement to the model, the proton reaction cross sections were estimated independently using the prescriptions of Karol, and DeVries and Peng. The systematic trends that emerge from this analysis are discussed. 12 refs., 5 figs.

57922 (CONF-8704112—, pp 393-397) **Recoil accelerator mass spectrometry of nuclear reaction products.** Paul, M.; Fink, D.; Hollos, G. (Hebrew Univ., Jerusalem (Israel)). 1987. Elsevier Science Publishers Co. Inc., 52 Vanderbilt Ave., New York 10017. Order Number TI88013520/JAW.

From 4. international symposium on accelerator mass spectrometry; Ontario, Canada (27 Apr 1987).

The authors propose to use the technique of Accelerator Mass Spectrometry (AMS) to detect slow heavy products of nuclear reactions by accelerating them immediately after their production and recoil from a target. The AMS method is conventionally applied to the measurements of very low concentrations of specific isotopes by extracting them from an ion source. It may be possible to apply the technique also to the detection of rare products of nuclear reactions induced by an ion beam on a target. The method would be particularly suited to the detection of very slow heavy nuclei which are not directly detectable or identifiable by usual methods. Their subsequent acceleration could provide them with an energy adequate for their identification by AMS methods and their discrimination from the primary beam. A class of nuclear reactions which seems to be suited to the proposed technique is that of radiative capture. They present here the results of an experiment in which heavy nuclei produced by bombarding a carbon target with a ^{12}C beam at 12 MeV were analyzed by recoil accelerator mass spectrometry. The carbon foil, normally used as a stripper din the high-voltage terminal of the 14UD Rehovot Pelletron tandem accelerator served as the target for the $^{12}C^{-}$ beam and recoiling accelerated nuclei were detected and identified by momentum and energy dispersion and time-of-flight measurements.

57923 (INIS-SU—49, pp 4-10) **Cumulative antiproton observation.** Averichev, G.S.; Zarubin, P.I.; Litvinenko, A.G. and others. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89780012/JAW.

Preprint 5(25)-87.

In JINR rapid communications. Collection.

Results on the antiproton production on Pb and Al nuclei in the region kinematically forbidden for nucleon-nucleon collisions are presented. The investigation was carried out on the DISK magnetic spectrometer operating on the extracted beam of JINR synchrophasotron. Estimations of invariant differential cross-sections of cumulatie antiproton production have been obtained for cumulative number X=1.47 on aluminium and lead targets. Upper cross-section has been estimated at X=1.85. The power of A-dependence has been estimated, too: a=1.00 +- 0.12. 10 refs.; 3 figs.; 2 tabs.

6515 Nuclear Properties And Reactions, A=39-58, Experimental

57924 **(LA-UR—88-3294) Utilization of an intense beam of 800 MeV protons to prepare radionuclides.** O'Brien, H.A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 20p. (CONF-881151—9). NTIS, PC A03/MF A01. Order Number TI89000324/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

Since the early 1970's, a program has been underway at this institution to employ the excess proton beam emerging from the major experimental areas of the LAMPF accelerator to make a wide variety of radioactive nuclides. This paper presents a review of the targets irradiated, cross section data, and nuclide yield measurements. 32 refs., 1 figs., 8 tabs.

6516 Nuclear Properties And Reactions, A=59-89, Experimental

57925 **Nuclear Data Sheets for A = 68.** Bhat, M.R. (National Nuclear Data Center, Brookhaven National Laboratory, Upton, NY 11973, U.S.A.). *Nuclear Data Sheets;* **55**: No. 1, 1-70(Sep 1988).

The 1981 evaluation of A = 68 (81Ke14) has been revised using experimental decay and reaction data received by April 27, 1988. Neutron reaction data: see the bibliography CINDA—A, CINDA—B, and supplements. copyright 1988 Academic Press, Inc.

6517 Nuclear Properties And Reactions, A=90-149, Experimental

57926 **(CONF-880896—4) Sub-barrier transfer reactions measured with a recoil mass separator.** Betts, R.R. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 11p. NTIS, PC A03/MF A01. Order Number DE89000606/JAW.

From Symposium on heavy-ion reaction dynamics in tandem energy region; Hitachi, Japan (1 Aug 1988).

The measurement of sub-barrier transfer reactions between heavy ions using a recoil mass separator is discussed. Data are presented for one and two particle transfer reactions of ^{58}Ni + /sup A/Sn and ^{58}Ni + /sup A/Sm over a range of bombarding energies from close to far below the interaction barrier. The data are analyzed in the framework of a semi-classical model of the transfer process. The results for one-nucleon transfer on the deformed targets show anomalous behavior. 8 refs., 9 figs., 2 tabs.

6518 Nuclear Properties And Reactions, A=150-189, Experimental

57927 **(CONF-880656—1) Unexpected structure in the E2 quasicontinuum spectrum of ^{154}Dy.** Holzmann, R.; Khoo, T.L.; Ma, W.C.; Ahmad, I.; Dichter, B.K.; Emling, H.; Janssens, R.V.F.; Drigert, M.W.; Garg, U.; Quader, M. (Argonne National Lab., IL (USA); Notre Dame Univ., IN (USA); Purdue Univ., Lafayette, IN (USA)). 1988. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01. Order Number DE89000546/JAW.

From Annual heat engines and gas stream cleanup; Morgantown, WV, USA (14 Jun 1988).

The evolution of the γ quasicontinuum spectrum with neutron number has been investigated in the sequence of dysprosium isotopes /sup 152,154,156/Dy. The three nuclei display a pronounced collective E2 component. In ^{154}Dy this component shows an unexpected splitting into two distinct parts, signifying a structural change along the γ cascade. The E2 and statistical components can be reproduced in simple γ cascade calculations; in ^{152}Dy and ^{156}Dy only rotational bands were included, whereas in ^{154}Dy additional vibration-like transitions were required to reproduce the two E2 peaks. 11 refs., 2 figs.

57928 **Nuclear Data Sheets for A = 157.** Helmer, R.G. (Idaho National Engineering Laboratory, EG&G Idaho, Inc., Idaho Falls, Idaho 83415, USA). *Nuclear Data Sheets;* **55**: No. 1, 71-179(Sep 1988).

The experimental results from the various decay and reaction studies leading to nuclides in the A = 157 mass chain, and α decays from it, have been reviewed. These data are summarized and presented, together with adopted level schemes and properties. copyright 1988 Academic Press, Inc.

6519 Nuclear Properties And Reactions, A=190-219, Experimental

57929 **(CONF-880795—2) Gamma decay of giant resonances excited by heavy ions.** Halbert, M.L. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 12p. NTIS, PC A03/MF A01. Order Number DE88016810/JAW.

From Tokyo symposium on heavy-ion and nuclear astrophysical problems; Tokyo, Japan (19 Jul 1988).

Experiments on ^{208}Pb bombarded by ^{17}O at 22 MeV/nucleon (ORNL) and 84 MeV nucleon (GANIL) are reviewed. Inelastically scattered projectiles were detected at forward angles in coincidence with gamma rays seen in NaI (ORNL) or in BaF_2 (GANIL). The ^{17}O were identified by 6 Si telescopes covering Θ = 11. 5{degree}–14.5{degree} (ORNL) or by the focal-plane detector system of the energy-loss spectrometer SPEG, set to accept Θ = 1. 5{degree}–5.0{degree} (GANIL). The γ-ray data provide information on the multipole character of various parts of the giant resonance region, matrix elements between the GR region and low-lying states in ^{208}Pb, and the relative contribution of direct and compound process to γ_0 decay. At the higher energy the 9–15 MeV GR region is excited very strongly. The isovector giant dipole is dominant over most of the angles studied. Significant contributions from the isoscalar giant quadrupole and monopole resonances are also present. Decomposition of the GR into L = 1, 2, and 0 components was based on coincidences with the overwhelmingly dipole γ_0 transitions. The magnitude (1.7 +- 0.2%) and energy distribution of the γ_0 branch can be reproduced well by a parameter-free calculation. The γ_0 decay of the isoscalar giant quadrupole resonance is more easily observed at the lower energy. The γ_0 angular correlations confirm the presence of E2 radiation from states in the 9–11 MeV region. The B(E2) implies that the ratio of neutron to proton matrix elements is consistent with the expected value of N/Z. This conclusion is confirmed by evidence form Coulomb-nuclear interference in the singles data at 84 MeV/nucleon. Photon decays to excited states indicate that 4^+ and/or 6^+ strength is present around 9–10 MeV, and are consistent with a monopole contribution from 12.5–15.5 MeV. 20 refs., 14 figs.

6520 Nuclear Properties And Reactions, A=220 And Above, Experimental

57930 **(CBPF-NF—071/87) Photofission cross section of /sup 238/U in the quasi-deuteron region.** Bernabei, R.; D'Angelo, S.; Pascale, M.P. de; Schaerf, C.; Pinheiro Filho, J. de D.; Girolami, B.; Oliveira, V.C. de; Martins, J.B.; Tavares, O.A.P. (Rome Univ. (Italy); Universidade Federal Fluminense, Niteroi (Brazil); Instituto Nazionale de Fisica Nucleare, Rome (Italy)). (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1987. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703963/JAW.

The photofission cross section of /sup 238/U induced by monochromatic and polarized photons has been measured using LADON facility at the Frascati National Laboratory. The experiment has been performed at six different energies in the range 46-72 Mev by detecting the fission fragments either in uranium-loaded nuclear-track emulsion plates or in uranium-mica sandwiches. Results are consistent with existing data, however they suggest the opportunity of further investigation in this energy range.

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 57705, 57902, 57903, 57920, 57926, 57927, 58204

57931 (ANL-HEP-CP—88-38) Nuclear chromodynamics is not the colorization of nuclear physics. Sivers, D. (Argonne National Lab., IL (USA)). 19 Jul 1988. Contract W-31109-ENG-38. 14p. (CONF-880560—5). NTIS, PC A03/MF A01. Order Number DE89000519/JAW.

From Topical conference on nuclear quantum chromodynamics; Argonne, IL, USA (19 May 1988).

The successful description of nuclei in terms of nucleons, deltas and mesons provides an enormous challenge to QCD. It compels us to pursue our theoretical understanding of chromodynamics into the realm of multiple color singlets in order to examine the concept of color saturation. To pursue this theme, we examine the idea of nuclear transparency in the light of models for confinement and describe the formulation of lattice simulations sensitive to exchange forces. 22 refs., 7 figs.

57932 (ANL-HEP-CP—88-47) Reactions probing effects of quark clusters in nuclei. Lassila, K.E.; Sukhatme, U.P. (Argonne National Lab., IL (USA); Illinois Univ., Chicago (USA). Dept. of Physics). 1988. Contract W-31109-ENG-38. 5p. (CONF-880758—2). NTIS, PC A02/MF A01. Order Number DE89000590/JAW.

From Workshop on nuclear and particle physics on the light cone; Los Alamos, NM, USA (18 Jul 1988).

We study signatures of quark clusters in reactions which probe quarks in nuclei. We examine the EMC effect and use physical arguments to establish features of valence and ocean parton distributions in multiquark clusters. We predict from these distributions ratios of structure functions and cross sections measured with neutrino, antineutrinos and proton beams. It appears that a unique determination of the source of the EMC effect will be possible. 6 refs., 4 figs.

57933 (CBPF-NF—036/87) Restricted high-density percolation and nuclear fragmentation. Chao, N.-C.; Chung, K.C. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1987. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703958/JAW.

We propose a restricted high-density percolation that may belong to a new universality class. A Monte Carlo simulation for our model is performed with systems of finite number of FCC lattice sites within a sphere. The cluster distribution is shown to obey a power law with an exponent tau {similar←to} 2,50 at critical probability pc {similar←to} 0,5. Comparisons with experimental data from p + Kr and p + Xe collisions are made.

57934 (CONF-880639—6) From the secrets of nuclear shapes into quantum nuclear phyics. Dudek, J. (Oak Ridge National Lab., TN (USA); Strasbourg-1 Univ., 67 (France)). 1988. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01. Order Number DE88016814/JAW.

From International conference on contemporary topics in nuclear structure physics; Cocoyoc, Mexico (9 Jun 1988).

After a few 'historical remarks' related to the evolution of our knowledge on nuclear shape effects, recent events in super-deformation studies are commented from the point of view of their general importance for nuclear physics. 12 refs.

57935 (CONF-880845—1) Effect of material environment on a class of nuclear lifetimes. Perlow, G.J. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 14p. NTIS, PC A03/MF A01. Order Number DE89000531/JAW.

From Meeting on nuclear methods in magnetism; Munich, F.R. Germany (1 Aug 1988).

The connection between internal conversion of a nuclear transition and EXAFS is pointed out. A prediction is made of sizable variations of lifetimes of nuclear states depending on the surrounding material environment, provided that the transition energy is just above threshold and the internal conversion coefficient is appreciable. 12 refs., 2 figs.

57936 (CONF-8806130—4) Systematics of light nuclei in a relativistic model. Price, C.E. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01. Order Number DE89000624/JAW.

From Relativistic nuclear many-body physics conference; Columbus, OH, USA (6 Jun 1988).

The results of relativistic mean field calculations for nonspherical nuclei are presented and discussed. The need for nonlinear scalar meson self-couplings in order to describe the properties of s-d shell nuclei is emphasized along with the importance of self-consistency in calculations of magnetic moments of odd-mass nuclei. 16 refs., 3 figs., 2 tabs.

57937 (DOE/ER/40425—242) Nuclear structure theory: Technical progress report, September 1, 1987-August 31, 1988. French, J.B.; Koltun, D.S. (Rochester Univ., NY (USA)). 1988. Contract FG02-88ER40425. 14p. NTIS, PC A03/MF A01. Order Number DE88017254/JAW.

This report summarizes progress in the following areas of research: pion charge exchange reactions, including further development of models of coupling to nonelastic channels, and application of new optical theorems for DCX to the isospin structure of the optical model. Quark models and nuclear inelastic scattering, including new momentum-space methods for calculating form-factors, response functions, etc., for inelastic scattering from nuclei. A unified theory of reaction dynamics and nuclear structure, including new applications to charge exchange scattering of pions from oriented or unoriented Ho targets, using coupled channel methods. Weak interactions, including the relation of symmetries to the neutrino mass matrix. Fluctuation-free statistical spectroscopy including the theory and computer programs for interacting-particle state densities, spin-cutoff factors, occupancies, strength sums and other expectation values. Studies of dynamical symmetries in the "Interacting Boson-Fermion Model" (IBFM) including those associated with the SU(3) limit of the IBM, and symmetries deriving from the group U/sup B/(6) {circle←times} U/sup F/(20).

57938 (EFI—956(6)-87) Bound nucleon structure function in the picture of relativistic constituent quarks. Grigoryan, L.A.; Shakhbazyan, V.A. (Erevanskij Fizicheskij Inst. (USSR)). 1987. 24p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704317/JAW.

The structure function F/sub 2N/ of nucleons in the deuterium, carbon and iron nuclei is calculated as a function of Q/sup 2/ in two approaches: taking into account the nucleon swelling in nuclei due to the partial deconfinement of quarks in nuclear medium; in the conventional approach of nuclear physics, taking into account the getting off the mass shell of the bound nucleon and Fermi motion in nucleons. It is shown that the conventional approach of nuclear physics does not explain the EMC effect in the region of small x. 18 refs.; 3 figs.

57939 (EFI—973(23)-87) Pion multiplicity distribution moments in nucleus-nucleus collisions and experimental verification of the independent interactions model. Gulkanyan, G.R.; Korchagin, S.A.; Sarkisyan, S.A. (Erevanskij Fizicheskij Inst. (USSR)). 1987. 14p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704322/JAW.

On the basis of earlier proposed model of experimental reduction of distribution moments of the number of interacted nucleons of the projectile-nucleus, predictions are made for the pion multiplicity distribution moments in nucleus-nucleus collisions, assuming that the incident nucleus nucleons interact with the target-nucleus independent of each other. The comparison of predictions with experimental data on π/sup -/ and π/sup 0/-meson distribution moments (up to th 6th order) in 4.2 GeV/cA C-Ta collisions once more proves of the dominance of the independent interaction mechanism in the multiple production of pions. 10 refs.; 3 tabs.

57940 (FNAL/C—88/81) Electron and muon physics sessions: Summary. Montgomery, H.E. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1988. Contract AC02-76CH03000. 7p. (CONF-8805142—40). NTIS, PC A02. Order Number DE88016466/JAW.

From 3. international conference on the intersections between particle and nuclear physics; Rockport, ME, USA (14 May 1988).

The electromagnetic interaction needs no introduction as a probe of the structure of systems on many scales. The continued use of this technique dominated the sessions on Electron and Muon Physics at the Samoset Meeting. The experimental results continue to stimulate large numbers of theorists and the results on polarized deep inelastic muon scattering and their various interpretations permeated beyond these sessions. The breadth of physics attacked with electrons and muons makes a summary such as this rather peculiar. As one of my nuclear physics friends (I think) commented after my summary, "it was interesting to see Nuclear Physics from a long distance with the telescope inverted." The comment may well be applied to this written version of the summary talk. 21 refs.

57941 (IAE—4452/2) **Intensities of the unflavorable transitions in the actinide α-decay.** Kulakov, V.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1987. 27p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703505/JAW.

A new classification of intensities of unreasonable a-transitions taking into account the probability of production of an a particle with partial angular momentum in the nucleus is suggested. A strong spin-flip effect (ΔΣ) on the probability of partial wave formation is established. A new interpretation of schemes of /sup 227/Ac, /sup 229/Th, /sup 235/U etc. energy level is suggested. 20 refs.; 3 figs.; 7 tabs.

57942 (IAEA-TECDOC—457, pp 151-158) **Systematics of excitation function for (n, charged particle) reactions.** Zhao Zhixiang; Zhou Delin. (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

On the bases of evaporation model considering the preequilibrium emission under some approximations, the analytical expressions including two adjustable parameters have been derived for excitation functions of (n, charged particle) reactions. Fitting these expressions to the available measured data, these parameters have been extracted and the systematic behaviours of the parameters have been studied. More accurate predictions than before could be obtained by using these expressions and systematics parameters. (author). 18 refs, 11 figs, 1 tab.

57943 (IAEA-TECDOC—457, pp 159-162) **Systematics of (n,2n) and (n,3n) cross-sections.** Zhang Jin; Zhou Delin; Cai Dunjiu. (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

A body of new measurements of (n,2n) and (n,3n) reaction excitation function for the energy region up to 30 MeV has been fitted to the parameterized formulae with two adjustable parameters based on the constant temperature evaporation model taking account of the preequilibrium contribution. The systematic behaviours of those parameters have been studied. (author). 3 refs, 4 figs.

57944 (INIS-BR—1229, pp 87) **Bags in the shell model.** Betz, M.; Krein, G.; Maris, T.A.J. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57945 (INIS-BR—1229, pp 87) **Recent developments in quasi-free nucleon-nucleon scattering.** Kitching, P.; McDonald, W.J.; Maris, T.A.J.; Vasconcellos, C.A.Z. (Alberta Univ., Edmonton (Canada)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57946 (INIS-mf—11311, pp 4) **Recent developments in radioactivity.** Stolz, W. (Bergakademie Freiberg (German Democratic Republic). Sektion Physik). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57947 (ITEF—208(1987)) **Method of composite quark bags in a four-nucleon problem.** Baryshnikov, A.G.; Blokhintsev, L.D.; Narodetskij, I.M.; Savin, D.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 25p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704363/JAW.

Nucleon-nucleon potentials obtained by the method of composite quark bags are used for calculation of the binding energy and wave function in the four-nucleon system. The calculations are based on solution of integral equations for the wave function of the bound state using Gilbert-Schmidt method. The value Z/sub α/=29 MeV is predicted for binding energy of α-particle. Vertex constants for virtual decays t->dn, d->tp and α->dd are calculated. 29 refs.; 6 figs.

57948 (ITF—87-49) **On a model independence of a nd-system in a doublet state.** Simenog, I.V.; Shapoval, D.V. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1987. 15p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704369/JAW.

A model-independent solution of the nd-scattering problem in a doublet state, that explains the qualitative characteristics of a three-nucleon system at low energies and the correlations between the parameters of a doublet scattering amplitude is obtained. The dependence of the doublet scattering length on the triplet and singlet r/sub t/ and r/sub s/ effective interaction radii is investigated. The dependence of the triton binding energy on the r/sub t/ and r/sub s/ is found. 21 refs.; 3 figs.

57949 (ITP—87-37) **High-energy diffractive pα scattering.** Jenkovszky, L.L.; Polozov, A.D.; Shalabanov, O.V.; Struminskij, B.V. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1987. 24p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704371/JAW.

High-energy elastic rhoα scattering data are analyzed by means of the multiple scattering formalism due to Glauber and Sitenko. The complicated structure of the pp-scattering amplitude at high energies is emphasized and different choices of the form factor are discussed. It is shown that the existing data can be fitted without introducing new degrees of freedom. 22 refs.; 10 figs.; 3 tabs.

57950 (JINR-D—1,2-86-668, pp 261-276) **Space-time picture of relativistic nuclear collisions and its manifestation in the secondary particle spectra.** Botvina, A.S.; Il'inov, A.S.; Gudima, K.K. and others. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij; AN Moldavskoj SSR, Kishinev. Inst. Prikladnoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88780187/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

High-energy nuclear collision mechanisms are studied and description possibility of these processes space-time pattern within the scope of partial transparency models (PTM), hydrodynamic model (HDM) and internuclear cascade model (INC) is considered. Analysis of theoretical predictions and experemental data for proton inclusive spectra from /sup 1/2C+/sup 1/2C reaction with E/sub l/ab=3.6 GeV/nucleon and angular dependencies of proton yield in this reaction, from /sup 2/0Ne+/sup 2/0Ne reaction with E/sub l/ab=2.1 GeV/nucleon within central collision region, is carried out. Universality origin problem of proton inclusive spectra producting in nucleus-nuclear and hadron-nuclear collisions is considered. Compared analysis shows, that PTM, HDM and INC-models explain the rapidity distributions universal behaviour within the target fragmentation region. Description deficiencies of proton spectra universality in the used models are marked. Nuclear system

properties, such as excitation and decay of spectator parts of nuclei spectator matter fragmentation, with {similar←to}10 MeV/nucleon are considered. The conducted analysis showed, that proton inclusive spectra in collisions of similar nuclei are sensitive to model effects with collision initial energy rise. This sensitivity manifests especially in the inclusive spectra rapidity representation. It is noted, that the realistic space-time pattern of realistic nuclear collisions is described well by PTM, HDM and INC models. 28 refs.; 8 figs.

57951 (JINR-D—1,2-86-668, pp 277-282) **Search for collective effects in relativistic nucleus-nucleus collisions.** Mekhtiev, R.R.; Cheplakov, A.P. 1987. (In Russian). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88780187/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

Correlation characteristics of inelastic CTa- and CC-multinucleon interactions at 4.2 GeV/c per nucleon are studied to search collective effects in relativistic nucleus-nuclear interactions. Secondary p- and PI-particle sharacteristics are studied depending on the collided nuclei interacting proton number, the impact parameter. Variable sphericity distributions in all CTa- and CC-collisions and in events with large proton number are presented. Q/sub F/ angular distributions in CC- and CTa-collisions and mean Q/sub F/ angle dependence on proton number in these interactions are considered with the Q/sub F/ 'energy flow angle' terms and the Dubna cascade model version. Experimental data analysis within Q/sub F/ terms is admitted useful for nucleus-nuclear interaction dynamics explanation and search for the peculiarities which lay beyond the nuclear interaction presentation as a nucleon-nucleon collision ordinary superposition. 6 refs.; 7 figs.

57952 (JINR-E—3-87-537) **On peculiarities of the cascade γ decay of heavy nuclei.** Boneva, S.T.; Khitrov, V.A.; Popov, Yu.P.; Sukhovoj, A.M.; Vasil'eva, E.V.; Yazvitskij, Yu.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1987. 3p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704380/JAW.

Comparison of measured and calculated by statistical theory sums of two-quanta cascade intensities in compound-nuclei 163 ≦ A ≦ 183 points to the dependence of cascade intensity on the structure of initial and intermediate levels. The dependence of two-quanta cascade intensity sum on reduced neutron widths of compound states of even-even nuclei-targets of rare earth regions is detected. In /sup 175/Yb and /sup 179/Hf nuclei a considerable increase in the intensity of two-quanta cascades at the energy of their intermediate level in the range of the calculated position of one-quasiparticle states of the Saxon-Woods deformed potential is observed. 8 refs.; 2 figs.

57953 (JINR-R—1-87-807) **Analysis of cumulative hadron-nucleus interactions at 4-40 GeV/c depending on target mass.** Baatar, Ts.; Tuvdendorzh, D.; Lyubimov, V.B.; Togoo, R. (Inst. Fiziki i Tekhniki AN MNR, Ulan-Bator). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704383/JAW.

Submitted to the journal Sov. J. Nucl. Phys. .

Special properties of cumulative pC and PI/sup -/C interactions at P/sub P/=4.2, P/sub p/=10 GeV/c are analyzed by means of 2m propane chamber as a function of minimum value of a mass of object with which an incident hadron interacts. Multiple characteristics of cumulative collisions, distributions over velocities and transverse momenta of secondaries in them as well as inclusive spectra of cumulative hadrons are studied. Universal character of distributions of cumulative interactions, cumulative hadron multiplicity distributions have been discovered. 9 refs.; 7 figs.; 4 tabs.

57954 (JINR-R—2-87-824) **Angular and energy characteristics of neutrons produced by high-energy ion beam.** Polanski, A.; Sosnin, A.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1987. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704387/JAW.

Submitted to the journal At. Ehnerg. .

The results of Monte-Carlo calculated neutron spectra using intranuclear-cascade-evaporation model for treating high-energy inelastic collisions are presented. Thick copper and iron targets are irradiated by protons and /sup 12/C ions at 3.65 GeV/nucleon energy. For the case of incident protons and ions on a copper target, comparison is made with experimental data. In general, good agreement is obtained. 9 refs.; 8 figs.; 1 tab.

57955 (JINR-R—2-87-859) **Simulation of neutrino-nucleus interactions at energies E=3-30 GeV.** Grishin, V.G.; Eliseev, S.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704389/JAW.

Theoretical study of deep inelastic neutrino-nucleus interaction at 3-30 GeV is made by the simulation method. Calculations are carried out by Monte-Carlo method under conditions close to the planned experiment. Use was made of the model of multiple scattering of particles with the length of their formation (formation zone effect) taken into account. Characteristics are studied of branching processes in lead and copper nuclei at different neutrino energies and parameters of the formation length. It is shown that in many cases it is convenient to utilize heavy nucleus-targets for investigating the space-time evolution of multiparticle processes. 2 refs.; 5 figs.; 2 tabs.

57956 (JINR-R—4-87-746) **New formulae for a systematics of the total radiative widths.** Lomachenkov, I.A.; Furman, V.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1987. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704382/JAW.

In the framework of statistical approach with phenomenological parametrization of the energy dependence of the excited level density the equations for the total radiative widths of s-neutron resonances are obtained. Taking into account a satisfactory agreement between the calculation results and experimental data it is concluded that the obtained formulae for a more accurate systematics of the average radiative widths should be used. 16 refs.; 2 figs.; 1 tab.

57957 (LA-UR—88-2893) **Pion scattering and nuclear dynamics.** Johnson, M.B. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 28p. (CONF-880938—2). NTIS, PC A03/MF A01. Order Number DE89000385/JAW.

From International symposium on mesons and light nuclei; Rez, Czechoslovakia (5 Sep 1988).

A phenomenological optical-model analysis of pion elastic scattering and single- and double-charge-exchange scattering to isobaric-analog states is reviewed. Interpretation of the optical-model parameters is briefly discussed, and several applications and extensions are considered. The applications include the study of various nuclear properties, including neutron deformation and surface-fluctuation contributions to the density. One promising extension for the near future would be to develop a microscopic approach based on powerful momentum-space methods brought to existence over the last decade. In this, the lowest-order optical potential as well as specific higher-order pieces would be worked out in terms of microscopic pion-nucleon and delta-nucleon interactions that can be determined within modern meson-theoretical frameworks. A second extension, of a more phenomenological nature, would use coupled-channel methods and shell-model wave functions to study dynamical nuclear correlations in pion double charge exchange. 35 refs., 11 figs., 1 tab.

57958 (LA-UR—88-2918) **International conference on spin observables of nuclear probes: Summary talk.** Garvey, G.T. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 16p. (CONF-880386—9). NTIS, PC A03/MF A01. Order Number DE89000380/JAW.

From International conference on spin-observables in nuclear physics; Telluride, CO, USA (14 Mar 1988).

A selected summary of the presentation and discussions at the 4th Telluride Conference is presented. The summary deals

mainly with the effects of nuclear spin and isospin on the interaction between nucleons and their consequences in nuclear structure. 11 figs.

57959 **(LA-UR—88-2920) Green's function Monte Carlo calculations of ^{4}He.** Carlson, J.A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 16p. (CONF-8806234—2). NTIS, PC A03/MF A01. Order Number DE89000379/JAW.

From Conference on electron scattering from nuclei; Marciana Marina, Italy (7 Jun 1988).

Green's Function Monte Carlo methods have been developed to study the ground state properties of light nuclei. These methods are shown to reproduce results of Faddeev calculations for A = 3, and are then used to calculate ground state energies, one- and two-body distribution functions, and the D-state probability for the alpha particle. Results are compared to variational Monte Carlo calculations for several nuclear interaction models. 31 refs.

57960 **Thermal shape fluctuations, Landau theory, and giant dipole resonances in hot rotating nuclei.** Alhassid, Y.; Bush, B.; Levit, S. (Center for Theoretical Physics, Sloane Laboratory, Yale University, New Haven, Connecticut 06511). *Physical Review Letters;* **61**: No. 17, 1926-1929(24 Oct 1988).

A macroscopic approach to giant dipole resonances (GDR's) in hot rotating nuclei is presented. It is based on the Landau theory of nuclear shape transitions and provides a unified description of thermal fluctuations in all quadrupole shape degrees of freedom. With all parameters fixed by the zero-temperature nuclear properties the theory shows a very good agreement with existing GDR measurements in hot nuclei. The sensitivity of the GDR peak to the shape of hot nuclei is critically examined. Low-temperature experimental results in Er show clear evidence for changes in the nuclear energy surface while higher-temperature results are dominated by the fluctuations.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 56367, 57598, 58204, 58206, 58211, 58212

57961 (INIS-mf—11311, pp 13-14) **Approximations for broad beam gamma ray attenuation in the energy-range from 0.1 to 100 MeV.** Weber, K.H. (VEB RFT Messelektronik Otto Schoen, Dresden (German Democratic Republic)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57962 **(ORNL/RSIC—49) New gamma-ray buildup factor data for point kernel calculations: ANS-6.4.3 standard reference data.** Trubey, D.K. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Administration and Resources Management; Oak Ridge National Lab., TN (USA). Radiation Shielding Information Center). Sep 1988. Contract AC05-84OR21400. 106p. NTIS, PC A07/MF A01. Order Number DE89001317/JAW.

An American Nuclear Society Standards Committee Working Group, identified as ANS-6.4.3, has developed a set of evaluated gamma-ray isotropic point-source buildup factors and attenuation coefficients for a standard reference data base. The largely unpublished set of buildup factors calculated with the moments method has been evaluated by recalculating key values with Monte Carlo, integral transport, and discrete ordinates methods. Additional buildup factor data were obtained from PALLAS code results. Attention has been given to frequently-neglected processes such as bremsstrahlung and the effect of introducing a tissue phantom behind the shield. The proposed draft standard, provided as an appendix, contains data for a source energy range from 15 keV to 15 MeV and for 23 elements and 3 mixtures (water, air, and concrete). The buildup factor data are also represented as coefficients for the G-P fitting function. Tables giving correction factors for multiple scattering in tissue are also provided. 27 refs., 4 tabs.

57963 **(SAND—87-2715) A full-scale thermal test and analytical evaluation of the beneficial uses shipping system cask.** Moya, J.L.; Akau, R.L. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1988. Contract AC04-76DP00789. 83p. (TTC—767). NTIS, PC A05. Order Number DE88013826/JAW.

A thermal test of the Beneficial Uses Shipping System (BUSS) cask containing irradiation source capsules was conducted to verify a two-dimensional axisymmetric thermal model developed for the Safety Analysis Report. The BUSS cask is a Type B package developed to transport irradiation source capsules of cesium chloride or strontium fluoride to commercially licensed food and pharmaceutical irradiating facilities. The uniqueness of this test is that it was performed on an internally instrumented, full-scale cask with actual radioactive capsules. This resulted in more realistic system temperatures than those obtained if heaters were used to simulate the large gamma source. In addition, the thermal test provides benchmark data for other thermal codes. 12 refs.; 24 figs.; 2 tabs.

6550 Medical Physics

REFER ALSO TO CITATION(S) 56342, 56343, 56606, 57354, 57963

57964 **(IAEA-TECDOC—473) Revised guidance of the principles for establishing intervention levels for the protection of the public in the event of a nuclear accident or radiological emergency. Interim report on the development of revised guidance of the principles and application of intervention levels of dose.** (International Atomic Energy Agency, Vienna (Austria)). Jul 1988. 54p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704338/JAW.

An IAEA Advisory Group met in February 1987 to: i) review existing Agency guidance on intervention levels of dose and whether, and if so, what, revision is required; ii) consider whether, and if so, what additional guidance is required on limiting the stochastic risk and collective dose equivalent, and; iii) consider whether, and if so, what, additional guidance should be developed on derived intervention levels. The purpose of this Interim Report is to present to a broader audience the initial conclusions and recommendations of the Advisory Group in order that they may be used in conjunction with the guidance currently presented in Safety Series No. 72, pending publication of the revised Safety Series, scheduled for late 1989. 14 refs.

57965 **(IEN-DEFI—01/87) Study of contamination with /sup 137/Cs.** Silva, A.G. da. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1987. 10p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88703968/JAW.

The methodology and results of measurements accomplished (from October 30 to November 2,87) in a victim of an accident in Goiania (Brazil) are presented. Superficial and whole-body contamination using NaI detectors and Si-Au surface screens are studied. (M.A.C.).

57966 (INIS-mf—11311, pp 2) **Radiation risk and radiation protection concepts.** Doerschel, B. 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57967 (INIS-mf—11311, pp 4) **Possible application of the fuzzy set theory in radiation protection.** Schuricht, V. 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57968 **(INIS-mf—11311) Abstracts of 20. International Symposium Radiation Protection Physics.** (Technische Univ., Dresden (German Democratic Republic). Sektion Physik). 1988. 20p. (CONF-8804203—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW.

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

51 papers are presented as titles with abstracts which are processed individually for the INIS data base. They deal with general aspects of radiation protection physics, international activities in radiation protection, solid state dosimetry, models and calculation methods in radiation protection, and measuring techniques in radiation protection.

57969 (INIS-mf—11311, pp 2-3) **Some remarks on implementation of new quantities in external irradiation monitoring (oral).** Bucina, I.; Prouza, Z. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia); Karlova Univ., Prague (Czechoslovakia). Biofyzikalni Ustav). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57970 (INIS-mf—11311, pp 3) **Influence of phantom shape on personnel dosemeters response in the light of the new ICRU quantities.** Nikodemova, D.; Hrabovcova, A.; Vicanova, M. (Research Institute of Preventive Medicine, Bratislava (Czechoslovakia)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57971 (INIS-mf—11311, pp 3) **Method for the superficial and penetrating dose equivalents evaluation in the Czechoslovak National Personnel Dosimetry Service.** Starostova, V.; Trousil, J.; Koten, J.; Prouza, Z. (Institute for Research, Production and Application of Radioisotopes, Praha (Czechoslovakia)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57972 (INIS-mf—11311, pp 4) **IAEA co-ordinated research programme on intercomparison for individual monitoring.** Aleinikov, V.E. (International Atomic Energy Agency, Vienna (Austria)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57973 (INIS-mf—11311, pp 4-5) **Problems in assessing radiation exposure to the public in the GDR.** Przyborowski, S. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57974 (INIS-mf—11311, pp 5) **Internal irradiation of Czechoslovak population after the Chernobyl accident I. (oral).** Malatova, I.; Bucina, I.; Koublova, I.; Drabova, D.; Thomas, J. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57975 (INIS-mf—11311, pp 6-7) **Current state of the indoor radon problem in CSR.** Thomas, J. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57976 (INIS-mf—11311, pp 9) **Cosmic ray response of thermoluminescence dosimeters used for nuclear plants vicinity monitoring.** Carny, P.; Lieskovsky, M. (Nuclear Power Plant Research Institute, Trnava (Czechoslovakia)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57977 (INIS-mf—11311, pp 14) **Assessment of the /sup 131/I dose equivalent on thyroid gland using various calculation models.** Hrabovcova, A.; Beno, M.; Vladar, M. (Research Institute of Preventive Medicine, Bratislava (Czechoslovakia)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57978 (INIS-mf—11311, pp 15) **Radiation exposure calculations for transport workers and the public using the INTERTRAN program.** Fasten, C.; Zappe, D.; Nitsche, F. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic); VEB Kernkraftwerk Bruno Leuschner, Greifswald (German Democratic Republic)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57979 (INIS-mf—11311, pp 7) **Internal irradiation of Czechoslovak population after the Chernobyl accident II. (poster).** Malatova, I.; Bucina, I.; Koublova, I.; Drabova, D.; Thomas, J. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia)). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57980 (INIS-mf—11311, pp 13) **Calculation of radiation field of container with collimated gamma beam.** Musilek, L.; Cechak, T.; Kluson, J. (Technical University of Prague (Czechoslovakia). Faculty of Nuclear Science and Physical Engineering). 1988. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704272/JAW. (CONF-8804203—).

From 20. international symposium on radiation protection physics; Gaussig, German D.R. (25 Apr 1988).

57981 **(IPEN-Pub—128) Beta radiation field of a /sup 85/Kr source.** Caldas, L.V.E.; David, J. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Dec 1987. 14p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703590/JAW.

The beta radiation field of a /sup 85/Kr(3,7GBq) source utilized in industrial applications was determined, with the use of gamagraphy films, a scintillation detector, an extrapolation chamber and thermoluminescent (TL) dosemeters of CaSO/sub 4/: Tm. Among other characteristics, the isodose curves of beta radiation and Bremsstrahlung radiation were obtained experimentally.

57982 **(OEFZS—4440) Determination of radon in housing rooms.** Steger, F.; Sorantin, H.; Kozuh-Schneeberger, J.; Lovranich, E.; Khademi, B. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Strahlenschutz). (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Mar 1988. 39p. (In German). (ST—154/88). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704055/JAW.

Radon concentration in 171 apartments with 503 rooms in and around Vienna was measured by a passive measuring system. Polycarbonate foils were exposed during 3 months; the nuclear tracks were visualized by electro-chemical method and evaluated. In housing- and sleeping rooms the mean concentration was 1,03 pCi/l, in cellars 2,15 pCi/l. The equivalent dosis, with 1,03 pCi/l was estimated to 90 mrem/a. At the same time the external radiation dose in the same rooms was measured by TL dosimeters and the dose estimated is again 90 mrem/a. 34 refs., 16 figs., 4 tabs. (qui).

57983 **(SSI—87-24) Long term limitation of cesium intake from foodstuffs.** (National Inst. of Radiation Protection, Stockholm (Sweden)). Apr 1987. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755274/JAW.

Summary and translation of SSI-rapport 87-16.

The text is an edited summary of SSI's recommendations to the National Food Administration. In response to the recommendations, the Food Administration has issued diet recommendations and taken decisions on new maximum limits for food sold over-the-counter (effective from June 1, 1987). The diet recommendations aim at keeping yearly intakes below 50 000 (or, for informed persons accepting the extra risk, 500 000) Bq Cs-137 per year. The limits for food sold over-the-counter are 300 Bq Cs-137/kg, as before, for basic foodstuffs (including beef, pork, mutton, poultry, cereals, fruits and berries, vegetables, dairy produce, infant food and fish caught in the sea), but 1 500 Bq for other foodstuffs (such as reindeer and venison).

6560 Condensed Matter Physics

REFER ALSO TO CITATION(S) 56911, 57001, 57023, 57907

57984 **(AD-A—195205/0/XAB) High-resolution low-energy electron reflection from W(100) using the electron energy-loss spectrometer: a step towards quantitative analysis of surface vibrational spectra.** Woods, J.P.; Erskine, J.L. (Texas Univ., Austin (USA). Dept. of Physics). Aug 1987. 6p. NTIS, PC A02/MF A01.

Pub. in Jnl. of Vacuum Science and Technology A, Vol. 5, No. 4, 435-439(Jul-Aug 1987).

High-resolution low-energy electron-reflection measurements and electron energy-loss measurements for clean W(100) and for the hydrogen-saturated phase (B_1) on W(100) are reported. The ability to perform both low-energy reflectance, low-energy electron diffraction, and high-resolution electron energy-loss experiments on the same crystal using the same electron optics permits several novel experiments. For example, it is possible to quantitatively test the dipole scattering mechanism and examine dipole and impact loss cross sections under precisely defined scattering conditions (i.e., under diffracted beam emergence conditions or at energies corresponding to reflectance resonance conditions). Under certain scattering conditions, the dipole scattering selection rule is shown to break down. Suitable modifications of the electron-optics-control electronics also permit direct measurements of the cross-section energy dependence of vibrational losses. These new features represent an important step towards quantitative applications of vibrational spectroscopy based on comparing electron energy-loss spectroscopy signals from chemisorbed species on different crystal surfaces.

57985 **(AD-A—195206/8/XAB) Electronic properties of Nb and H-treated Nb surfaces.** Fang, B.S.; Ballentine, C.A.; Erskine, J.L. (Texas Univ., Austin (USA). Dept. of Physics). 15 Nov 1987. 5p. NTIS, PC A02/MF A01.

Pub. in Physical Review B, Vol. 36, No. 0 (15 Nov 1987).

Clean niobium and hydrogen-treated Nb surfaces are studied using angle-resolved photoemission. Intrinsic surface states and hydrogen-induced states are characterized along the gamma - x direction of the two-dimensional Brillouin zone. Hydrogen-induced states exhibit reversible temperature-dependent effects providing direct experimental evidence of the self-trapped surface states that have been proposed to account for novel properties associated with hydrogen uptake by Nb.

57986 **(BNL—41774) Mass distribution of products of cluster impacts.** Beuhler, R.J.; Friedman, L. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 5p. (CONF-8809134—1). NTIS, PC A02/MF A01. Order Number DE88017338/JAW.

From 2. international workshop on MeV and KeV ion and cluster interactions with surfaces and materials; Orsay, France (5 Sep 1988).

Mass distributions of ionic atomic and molecular fragments sputtered from carbon surfaces by singly charged positive cluster ions containing 80 water molecules have been determined. With cluster kinetic energy of 240 keV significant yields of molecular fragments containing up to 21 carbon atoms were observed. Ion yields were used to estimate relative yields of neutral fragments with the assumption that relative yields of the respective ionic and neutral sputtering processes were determined by kinetic factors which could be evaluated independently. The derived neutral yields were then used to estimate the fraction of total projectile energy utilized in evaporative cooling, i.e., sputtering. The results indicate a major fraction of the energy available is used in the cluster sputtering process. 9 refs., 1 tab.

57987 **(CONF-860911—32) History of computers in crystallography.** Busing, W.R. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 11p. NTIS, PC A03. Order Number DE88017127/JAW.

From 192. American Chemical Society national meeting; Anaheim, CA, USA (7 Sep 1986).

Even in the early days of x-ray crystallography, extensive calculations were necessary in order to extract meaningful information from the data. It is not surprising, therefore, that the advent of modern computers has had a strong impact on this field. Computer-controlled diffractometers collect intensity data automatically. Fourier syntheses which used to be made with desk calculators and analog computers are now computed by fast-Fourier- transform methods. Least-squares refinement of crystal structures provides precise molecular parameters. The phase problem is solved by direct statistical methods. Computer graphics have advanced from producing drawings of molecules and their packing to the use of interactive displays for fitting macromolecules to calculated Fourier maps. The experimental results of crystal structure determinations are now available in extensive computer data bases. 48 refs.

57988 (INIS-BR—1229, pp 5) **Magnetic properties of the hydride Pd/sub 3/FeH/sub 0.7/.** Correa, M.H.P.; Schreiner, W.H.; Schmidt, J.E.; Viccaro, P.J.; Vasquez, A. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57989 (INIS-BR—1229, pp 25) **Direct ion implantation and radiation enhanced diffusion of tin into iron.** Dionisio, P.H.; Scherer, C.; Teixeira, S.R.; Baumvol, I.J.R. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57990 (INIS-BR—1229, pp 26) **Influence of He-vacancy complexes on the thermal behavior of nitrogen precipitates in Fe.** Behar, M.; Silva, M.T.X.; Zawislak, F.C.; Viccaro, P.J., Vasquez, A.; Santos, C.A. dos. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Argonne National Lab., IL (USA); Strasbourg-1 Univ., 67 (France); Rio Grande do Norte Univ., Natal (Brazil)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

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57991 (INIS-BR—1229, pp 30) **Ion implantation and radiation enhanced diffusion of tin into iron and steels.** Dionisio, P.H. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

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In Progress Report 1985-1986.

57993 (INIS-BR—1229, pp 44) **Chemical short range order in Fe/sub 20/Ni/sub 60/B/sub 20/ amorphous alloys.** Guimaraes, R.B.; Viccaro, P.J.; Schreiner, W.H.; Vasconcellos, M.A.Z.; Baibich, M.N. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57994 (INIS-BR—1229, pp 8) **Electrical transport properties of Bi/sub 3/Ni under helium irradiation and hydrogen implantation.** Amaral, L.; Nedellec, P.; Traverse, A.; Bernas, H.; Dumoulin, L.; Burger, J.P. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57995 (INIS-BR—1229, pp 11) **/sup 111/In Pd interactions in defect cascades in AgPd and CuPd.** Deicher, M.; Gruebel, G.; Recknagel, E.; Wichert, T. (Konstanz Univ. (Germany, F.R.). Fakultaet fuer Physik). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57996 (INIS-BR—1229, pp 11) **Distributions of light ions and foil destruction after irradiation of organic polymers.** Fink, D.; Biersack, J.P.; Chen, J.T.; Staedele, M.; Tjau, K.; Behar, M.; Olivieri, C.A.; Zawislak, F.C. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.); Freie Univ. Berlin (Germany, F.R.)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

57997 (INIS-BR—1229, pp 12) **Deep profile and thermal annealing behavior of Bi implanted into a Al/Ti bilayer structure.** Olivieri, C.A.; Behar, M.; Fichtner, P.F.P.; Zawislak, F.C.; Fink, D.; Biersack, J.P. (Sao Carlos Univ. (Brazil)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

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57998 (INIS-BR—1229, pp 12) **Range profiles of implanted Bi and Au in amorphous silicon.** Behar, M.; Fichtner, P.F.P.; Olivieri, C.A.; Souza, J.P. de; Zawislak, F.C.; Biersack, J.P. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

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In Progress Report 1985-1986.

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58001 (INIS-BR—1229, pp 19) **Mass and energy dependence of implanted ion profiles in the AZ111 photoresist.** Guimaraes, R.B.; Behar, M.; Livi, R.P.; Souza, J.P. de; Zawislak, F.C.; Fink, D.; Biersack, J.P. (Universidade Federal Fluminense, Niteroi (Brazil); Rio Grande do Sul Univ., Porto Alegre (Brazil)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58002 (INIS-BR—1229, pp 19) **Energy, mass and dose dependence of implanted ion distribution into polymer layers.** Zawislak, F.C. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58003 (INIS-BR—1229, pp 20) **Large Z/sub 1/ - range effect for Eu, yb and gold ions implanted in amorphized silicon.** Fichtner, P.F.P.; Behar, M.; Olivieri, C.A.; Livi, R.P.; Souza, J.P. de; Zawislak, F.C.; Fink, D.; Biersack, J.P. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

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In Progress Report 1985-1986.

58005 (INIS-BR—1229, pp 21) **Range profilles of ions in double-layer structures.** Fink, D.; Biersack, J.P.; Staedele, M.; Tjan, K.; Behar, M.; Fichtner, P.F.P.; Olivieri, C.A.; Souza, J.P. de; Zawislak, F.C. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.); Freie Univ. Berlin (Germany, F.R.). Inst. fuer Kernphysik). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

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58006 (INIS-BR—1229, pp 222) **Range distributions and thermal behaviour of Bi implanted into Kcl and Al/Kcl bilayer structure.** Behar, M.; Fichtner, P.F.P.; Zawislak, F.C.; Biersack, J.P.; Fink, D.; Olivieri, C.A. (Rio Grande do Sul Univ., Porto Alegre (Brazil); Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.); Sao Carlos Univ. (Brazil)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58007 (INIS-BR—1229, pp 24) **Electrical transport properties of Bi/sub 3/ Ni under helium irradiation and hydrogen implantation.** Amaral, L.; Nedellec, P.; Traverse, A.; Bernas, H. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58008 (INIS-BR—1229, pp 28) **Projected ranges and range stragglings of Au and Bi implanted into carbon films and into SIO/sub 2/.** Grande, P.L.; Fichtner, P.F.P.; Behar, M.; Livi, R.P.; Zawislak, F.C.; Biersack, J.P.; Fink, D.; Mertens, P. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58009 (INIS-BR—1229, pp 29) **Interdiffusion and reaction in the iron-aluminium bilayer I-Rutherford backscattering analysis of furnace annealed samples.** Teixeira, S.R.; Dionisio, P.H.; Baumvol, I.J.R.; Silveira, E.F. da; Freire Junior, F.L. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Pontificia Univ. Catolica do Rio de Janeiro (Brazil)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

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In Progress Report 1985-1986.

58012 (INIS-BR—1229, pp 34) **Residual defects in implanted silicon submitted to RTA: evidence of a chemical effect.** Hasenack, C.M.; Souza, J.P. de; Baumvol, I.J.R. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

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58013 (INIS-BR—1229, pp 34) **Channeling and conversion electron Moessabuer spectroscopy study of annealing behaviour of tin implanted silicon.** Scherer, E.M.; Souza, J.P. de; Hasenack, C.M.; Baumvol, I.J.R. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58014 (INIS-BR—1229, pp 35) **Suppression of residual defects of silicon implanted with group III, IV and V elements.** Hasenack, C.M.; Souza, J.P. de; Baumvol, I.J.R. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

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In Progress Report 1985-1986.

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In Progress Report 1985-1986.

58017 **(INIS-mf—11290) Mining Pribram in science and technology. Proceedings of Session U - Mineral raw materials treatment.** Tomasek, J.; Vetejska, K. (eds.). (Ceskoslovenska Vedeckotechnicka Spolecnost, Prague). 1987. 316p. (In English, Czech, Slovak, German). (CONF-8710342—). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88704267/JAW.

From Mining Pribram in science and technology; Pribram, Czechoslovakia (12 Oct 1987).

The proceedings of session "Mineral raw materials treatment" contain 27 papers of which only one deals with the application of nuclear technology, namely, the effect of fast electrons on the magnetic properties of the polymetallic Rudniany ore. (J.B.).

58018 (INIS-mf—11290, pp 59-68) **Effect of accelerated electrons on magnetic properties of Rudniany ore.** Zatko, S.; Jakabsky, S.; Bochkarev, G.R. (Slovenska Akademie Vied, Kosice (Czechoslovakia). Bansky Ustav; IGD SO AN USSR, Novosibirsk). 1987. (In Slovak). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88704267/JAW. (CONF-8710342—).

From Mining Pribram in science and technology; Pribram, Czechoslovakia (12 Oct 1987).

The results are presented of magnetic sorting of siderite and ferrobarite ores at a magnetic field intensity of 1,950 and 4,050 Oe, in variation with the accelerated electron dose within 4x10/sup 3/ and 1x10/sup 6/ J.kg/sup -1/. A dose response relationship could not be plotted from the results but in comparison with the results of sorting without radiation the present results are better. The irradiation was performed using an electron accelerator with a throughput of 30 to 100 tons of ore per hour. The results are also presented of magnetic sorting of siderite ore following fast electron irradiation for over 1.5 mins at a variable temperature of 200 to 700 degC. Some samples were treated under an H/sub 2/ reduction atmosphere. Varying the experimental conditions gave a magnetic fraction with an iron content of 49.43% and a yield of 82.40% as against a yield of 50.09% when fast electrons were not used. (J.B.).

58019 (INIS-SU—36, pp 55-56) **Computerized simulation orientation effects in radiation-induced damage by charged particles crystal.** Gann, V.V.; Dyul'dya, V.V.; Rozhkov, V.V. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88780176/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(39).

In Radiation damage physics and radiation material technology. Scientific-technical collection.

Brief characteristic of algorithm and program of computerized simulation of processes of charged particle interaction with crystals under axial channeling is presented. Possibilities of program application for studying wide range of problems, related to charged particle channeling and radiation monocrystal damage are described. 2 refs.

58020 (INIS-SU—36, pp 57-59) **Gamma-quantum yield and energy losses of channeled protons in the crystal Nb-0.2 at.% /sup 15/N in statistical equilibrium approach.** Deev, A.S.; Olejnik, V.A.; Svetashov, P.A.; Skakun, N.A. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88780176/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(39).

In Radiation damage physics and radiation material technology. Scientific-technical collection.

Computer calculation of normalized gamma-quantum yield from /sup 15/N (P, $\alpha\gamma$)/sup 12/ C reaction on atoms of nitrogen, dissolved in niobium monocrystal was conducted in the framework of continuous chain model under the condition of established statistic equilibrium. 5 refs.; 2 figs.

58021 (INIS-SU—41, pp 53-58) **Influence of surface anisotropy of displacement threshold energy on cascade function calculation.** Turkebaev, T.Eh. (AN Kazakhskoj SSR, Alma-Ata. Inst. Yadernoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780008/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 2(40).

In Radiation-induced damage physics and material technology. Scientific-technical collection.

Methods are developed and numeric calculation of a cascade function in copper monocrystal is conducted for different directions of PKA movement within the framework of Kinchin-Piez approach. The function possesses an oscillating character, conditioned

by displacement threshold energy surface anisotropy. Based on multiple calculations, conducted in the threshold energy isotropic surface approximation, an approxiamated expression for cascade function calculation is derived. 8 refs.; 2 figs.

58022 (INIS-SU—41, pp 61-62) **Phonon excitation at the development of the atom-atom collision cascade.** Gann, V.V.; Marchenko, I.G. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780008/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 2(40).

In Radiation-induced damage physics and material technology. Scientific-technical collection.

The process of nonequilibrium phonon excitation was investigated by mathematical simulation method. It was shown, that the phonon shift to the low frequency area was observed under atom-atom collision cascade development. This may sufficiently effect diffusion processes, dislocation separation from the keeper and dynamic reconstruction of cascade damage area. 5 refs.; 5 figs.

58023 (INIS-SU—41, pp 63-64) **Dependence of the silicon radiation damage efficiency on the dislocation density.** Larin, R.G.; Maslov, N.I.; Neklyudov, I.M. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780008/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 2(40).

In Radiation-induced damage physics and material technology. Scientific-technical collection.

Dependence of annealed and deformed silicon monocrystal radiation-induced damage efficiency on dislocation density under irradiation by 8 MeV energy electrons is investigated using the method of measuring the nonequilibrium charge carrier lifetime. 8 refs.; 2 figs.

58024 (INIS-SU—41) **Radiation-induced damage physics and material technology. Scientific-technical collection.** (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow; Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR)). 1987. 94p. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780008/JAW.

Individual papers in this collection are separately indexed.

58025 (INIS-SU—42, pp 3-7) **Electron-exciton scattering in shielding conditions odf Coulomb potentials.** Nabiev, R.F.; Popov, Yu.M. 1987. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89780009/JAW.

Kratkie Soobshcheniya po Fizike.; (no.8).

In Experimental and theoretical physics. Collection.

Quantum mechanical problem of electron scattering on exciton in one-state model taking account of the electron exchange in conditions of the Coulomb potential shielding by free charge carriers is solved. Shielding effect on electron-exciton system virial coefficient is investigated. 6 refs.; 1 fig.; 1 tab.

58026 (INIS-SU—44/A, pp 12-14) **Thermoelastic stresses in implanted ZnSe layers annealed by pulse electron beams.** Georgobiani, A.N.; Dement'ev, B.P.; Kotlyarevskij, M.B.; Yakubovich, N.I. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780010/JAW.

Kratkie Soobshcheniya po Fizike.; (no.10).

In Experimental and theoretical physics. Collection.

Behaviour of photoluminescence spectra of ZnSe monocrystal implanted layers, exposed to pulse annealing by electron beam with hypothreshold energy, was investigated. The results are interpreted within the framework of model which regards thermoelastic pressure occurence in thin layer at pulse annealing. 10 refs.; 2 figs.

58027 (INIS-SU—49, pp 18-24) **Anomalous dependence of the damage power on Z ions at the interaction with Ge single crystal.** Karamyan, S.A.; Rykhlyuk, A.V.; Bugrov, V.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1987. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89780012/JAW.

Preprint 5(25)-87.

In JINR rapid communications. Collection.

Damage power of heavy ions on Ge single crystal is measured by using the blocking effect under registration of scattered ions and recoil nuclei. Fluence range of 7x10/sup 13/ to 6x10/sup 15/ cm/sup -2/ of the /sup 40/Ar(24 MeV) and /sup 129/Xe (121 MeV) ions is covered. Significant macroheating of samples is excluded due to the condition os the experiment. Damage power of the Xe ions is found to be 10 times lower than of Ar ions in contrast to the known systematics. The result is explained by inclusion of a new mechanism of ion interaction with monocrystalline medium which consists in melting of the microscopical volume of the crystal along the particle track and consequent recrystallization. 11 refs.; 2 figs.

58028 (INIS-SU—59/A, pp 66-67) **General theory of secondary radiation yield in conditions of X-ray multi wave diffraction.** Kon, V.G. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780006/JAW.

Voprosy atomnoj nauki i tekhniki.; no.4(40).

In General and nuclear physics. Scientific-technical collection.

58029 **(IYF-R—9-296) Defect transformation in GSGG crystals during chromium ion activation.** Ashurov, M.Kh.; Nasyrov, I.N.; Khabibullaev, P.K. (AN Uzbekskoj SSR, Tashkent. Inst. Yadernoj Fiziki). 1987. 12p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704375/JAW.

Absorption and induced absorption spectra, dose dependence of induced absorption, thermoluminescence of GSGG crystals, nominally pure and activated with chromium and neodymium ions in different concentrations, are investigated. It is shown that it is chromium ion presence in large concentration that decreases the induced coloration in GSGG crystals after γ-irradiation at 300 K. Optimum concentration of chromium ions for the minimum of induced coloration are found. The mechanism of decrease of induced coloration consisting in Fermi level displacement by chromium ion activation is established. Defect concentration and localization and recombination possibilities of electrons and holes in GSGG crystals are estimated by computer simulation. 16 refs.; 6 figs.; 1 tab.

58030 **(LA-UR—88-2784) Classically exact surface diffusion constants at arbitrary temperature.** Voter, A.F.; Cohen, J.M. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 16p. (CONF-881002—6). NTIS, PC A03/MF A01. Order Number DE88016161/JAW.

From 35. national vacuum symposium and 4th international laser science conference; Atlanta, GA, USA (2 Oct 1988).

An expression is presented for computing the classical diffusion constant of a point defect (e.g., adatom) in an infinite lattice of binding sites at arbitrary temperature. The transition state theory diffusion constant is simply multiplied by a dynamical correction factor that is computed from short-time classical trajectories initiated at the site boundaries. The time scale limitations of direct molecular dynamics are thus avoided in the low and middle temperature regimes. The expression resulted from taking the time derivative of the particle mean square displacement in the lattice-discretized coordinate system. Applications are presented for surface diffusion on fcc(100) and fcc(111) Lennard-Jones crystal faces. 14 refs., 3 figs.

58031 **(LA-UR—88-2875) Propagation of high-energy laser beams through metallic aerosols.** Zardecki, A.; Armstrong, R.L. (Los Alamos National Lab., NM (USA)). Aug 1988. Contract W-7405-ENG-36. 9p. (CONF-8806239—2). NTIS, PC A02/MF A01. Order Number DE89000391/JAW.

From CRDEC scientific conference on obscuration and aerosol research; Aberdeen, MD, USA (22 Jun 1988).

By combining the results of the hydrodynamic code CON1D and the beam propagation code LASER, we investigate the propagation of high-energy laser beams through vaporizing metallic aerosols in the regime for which the plasma generation becomes important. An effective plasma absorption coefficient allows us to set up a coupled system of equations describing the system consisting of the beam and vapor. 14 refs., 5 figs.

58032 **(LA-UR—88-2876) Stimulated Brillouin scattering in solid aerosols.** Chitanvis, S.M. (Los Alamos National Lab., NM (USA)). Aug 1988. Contract W-7405-ENG-36. 18p. (CONF-8806239—1). NTIS, PC A03/MF A01. Order Number DE89000390/JAW.

From CRDEC scientific conference on obscuration and aerosol research; Aberdeen, MD, USA (22 Jun 1988).

We estimate the differential scattering cross-section due to SBS in a glass bead which is much larger than the wavelength of a high energy laser beam which irradiates it. We consider three possible scenarios: neither the incident nor the Stokes wavelength is on a Mie resonance; only the Stokes wavelength is on resonance; and the incident wavelength and the Stokes wavelength are on a Mie resonance. For the first two cases, we find that the SBS scattering cross-section is extremely small compared to the geometric/Mie cross-section. It follows as a corollary that SBS in a glass bead will be insufficient to shatter it in these two cases. In the last case, it is quite possible that due to the buildup of high fields on-resonance within the spherical bead, the bead might be shattered. The chance of such an event occurring in a polydisperse distribution of spherical beads is generally not expected to be very high. 3 figs.

58033 **(NORDITA—86/2(prepr.)) Nonuniversal critical behaviour in a model for charge density wave dynamics.** Ritala, R.K.; Hertz, J.A. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). Feb 1986. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755257/JAW.

We have studied short range fluctuations around the infinite-range model of charge density wave (CDW) dynamics. We find that the inhomogeneity of the local field, which is neglected in the infinite-range approximation has a dramatic effect on the transition. In the Bethe approximation the critical behaviour is nonuniversal. In particular, the current exponent is zeta = 3/2 log(z-1)/[log(z)]+log(1+f/J)], where z is the number of neighbors, f the pinning strength, and J the elastic coupling.

58034 **(NORDITA—86/4(prepr.)) Light quantum particles in a metallic environment.** Hedegad, P. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). Apr 1986. 34p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755258/JAW.

The basic mechanism that limits the quantum behavior of light particles are fluctuations in the environment. We here develop a path integral formalism that accounts for the influence of the environment on the quantum motion of such particles. As our prime example we discuss a particle that moves in a tight binding band and interacts with an electron gas environment. This situation has received experimental attention recently in the case of muon diffusion in metals, and in the theoretical discussion of hydrogen on metal surfaces. It is shown that the adiabatic approximation, usually applied to such problems, does not apply. This has basically two consequences. At low temperatures we find that the particle moves in Bloch states with a renormalized (more narrow) band width. For higher temperatures (k/sub B/T > W/sub ren/) the Bloch states acquire a lifetime that is shorter than K/W/sub ren/, which means a complete breakdown of the Bloch picture.

58035 **(NORDITA—86/6(prepr.)) Mode-locking in an infinite set of coupled circle maps.** Alstroem, P.; Ritala, R.K. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). Jun 1986. 59p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755259/JAW.

We show that the mode-locking in coupled circle maps with random phases is very different from that in a single circle map. A finite nonlinearity K/sub c/ is needed for a step to appear. The width of the step behaves as (K-K/sub c/)/sup 2/. The complete mode-locking (at K=1 for uncoupled maps) behaves singularly as the coupling is turned on. We argue that our model describes the mode-locking in charge-density-wave materials. Our results are in qualitative agreement with experimental observations by Sherwin and Zettl that only few true steps exist in I-V characteristics and that in addition to these there are some 'incomplete' steps.

58036 **(NORDITA—86/7(prepr.)) Discommensurations in icosahedral phases.** Chakraborty, B.; Sood, A.K.; Valsakumar, M.C. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Indira Gandhi Centre for Atomic Research, Kalpakkam (India). Materials Science Lab.). (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). Oct 1986. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755260/JAW.

The nature of the icosahedral phase is studied in the presence of competing commensurate ordering terms in the free energy. It is shown that the phase is a discommensurate one with a periodic array of domain walls (discommensurations) separating regions with long-period structure. These long-period structures have local icosahedral symmetry and their diffraction patterns closely resemble those of the icosahedral phase. In the discommensurate state the coherence length of the icosahedral phases would be determined by the domain-wall spacing. Recent experimental observations of antiphase boundary type defects in such systems probably indicate that the discommensurate state of the icosahedral phase is the one that is experimentally observed. We discuss the possibility of the discommensurations getting pinned by the lattice and the appearance of metastable states with random distribution of domain walls. These states are known to exhibit certain characteristic properties of glasses.

58037 **(NORDITA—86/10(prepr.)) Interatomic interactions in the effective medium theory.** Jacobsen, K.W.; Noerskov, J.K.; Puska, M.J. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Copenhagen Univ. (Denmark). H.C. Oersted Inst.; Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Haldor Topsoee Research Labs., Lyngby (Denmark); Helsinki Univ. of Technology, Otaniemi (Finland). Lab. of Physics). (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Copenhagen Univ. (Denmark). H.C. Oersted Inst.; Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Helsinki Univ. of Technology, Otaniemi (Finland). Lab. of Physics). Aug 1986. 70p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755262/JAW.

An expression is derived for the total energy of a system of interacting atoms based on an ansatz for the total electron density of the system as a superposition of atom densities taken from calculations for the atoms embedded in a homogeneous electron gas. This leads to an expression for the interaction energy in terms of the embedding energy of the atoms in a homogeneous electron gas, and corrections accounting for instance for the d-d hybridization in the transition metals. The density of the homogeneous electron gas is chosen as the average of the density from the surrounding atoms. Due to the variational property of the total energy functional the errors in the interaction energy is second order in the deviation of the ansatz density from the true ground state values. The applicability of the approach is illustrated by calculations of the chohesive properties of some simple metals and all the 3d transition metals. The interaction energy can be expressed in a form simple enough to allow calculations for low symmetry systems and will be very well suited for simulations of time dependent and finite temperature problems. Preliminary results for the phonon dispersion relations and the surface energies and relaxations for Al are used to illustrate the versatility of the approach. The division of the total energy into a density dependent part, an electrostatic 'pair potential' part, and a hybridization part provides a very simple way of understanding a number of these phenomena.

58038 **(SAND—88-7116) Electron energy deposition necessary to form an anode plasma in Ta, Ti, and C for coaxial bremsstrahlung diodes.** Sanford, T.W.L.; Halbleib, J.A.; Poukey, J.W.; Pregenzer, A.L.; Pate, R.C.; Heath, C.E.; Mock, R.; Mastin, G.A.; Ghiglia, D.C.; Roemer, T.J.; Spence, P.W.; Proulx, G.A. (Sandia National Labs., Albuquerque, NM (USA); Ktech Corp., Albuquerque, NM (USA); Pulse Sciences, Inc., San Leandro, CA (USA)). Aug 1988. Contract AC04-76DP00789. 66p. NTIS, PC A04/MF A01. Order Number DE89001039/JAW.

Measurements are made of surface doses necessary to initiate an anode plasma by electron bombardment of Ta, Ti, and C anodes for coaxial geometries characteristic of high-power electron-beam diodes. Measured lower and upper bounds of doses necessary to form an anode plasma are 54 +- 7 to 139 +- 16 J/g in Ta, 214 +- 23 to 294 +- 71 J/g in Ti, and 316 +- 33 to 494 +- 52 J/g in C. Within these bounds, probable values for the threshold are given under specific assumptions. The measurements are consistent with a thermal desorption model for plasma formation. 41 refs., 20 figs., 3 tabs.

58039 **(UCID—21487) Non-relativistic electron transport.** Ha, Z. (Lawrence Livermore National Lab., CA (USA)). 20 Jul 1988. Contract W-7405-ENG-48. 19p. NTIS, PC A03/MF A01. Order Number DE89000622/JAW.

If we want a complete solution for the electron transport properties through a solid, we can set up the problem using all the relevant components of the solid and interactions and solve the time dependent Schroedinger's equation. The first step toward making the problem simple is to come up with a reasonable model of the solid. We will not be able to use a single model to consider all the possible solids. Hence, we will restrict the solid to a simple metal. Let us say that a metal consists of conduction electrons and ion cores. We shall ignore all the rigid structures and will say that the electrons and ions are distributed randomly. There are basically five possible interactions that can occur between an energetic electron (with reasonably low energy) and the solid---electron-conduction e/sup {minus}/, electron-plasmon, electron-phonon, elastic collisions with ion cores, and ionization. We assume that these interactions are independent of each other and solve for the mean free paths (or cross section) for each interaction. Once we obtain the cross sections (or mean free paths) we will know the relative probability of an interaction with respect to all the other interactions. This result renders the Monte Carlo simulation as a natural way to solve the transport problem. We can randomly select the interaction to occur according to the relative probability of an event. Then we can calculate the energy loss and angular deviation for the electron that suffers the chosen interaction. We repeat the process of randomly selecting the interaction and calculating the energy loss and angular deflection for many electrons until the results get statistically sound. In this paper all the interactions are discussed. Since the full description of any one interaction can be very lengthy, only some important aspects of each interaction are mentioned. 34 refs., 3 figs.

58040 **(UCID—21510) Raman scattering in crystals.** Edwards, D.F. (Lawrence Livermore National Lab., CA (USA)). 30 Sep 1988. Contract W-7405-ENG-48. 49p. NTIS, PC A03/MF A01. Order Number DE89001284/JAW.

A tutorial presentation is given of Raman scattering in crystals. The physical concepts are emphasized rather than the detailed mathematical formalism. Starting with an introduction to the concepts of phonons and conservation laws, the effects of photon-phonon interactions are presented. This interaction concept is shown for a simple cubic crystal and is extended to a uniaxial crystal. The correlation table method is used for determining the number and symmetry of the Raman active modes. Finally, examples are given to illustrate the relative ease of using this group theoretical method and the predictions are compared with measured Raman spectra. 37 refs., 17 figs., 6 tabs.

58041 **(UCRL—98759) Positronium emission spectroscopy.** Howell, R.H.; Tuomisaari, M. (Lawrence Livermore National Lab., CA (USA)). Aug 1988. Contract W-7405-ENG-48. 6p. (CONF-8808122—9). NTIS, PC A02/MF A01. Order Number DE89001290/JAW.

From 8. international conference on positron annihilation; Gent, Belgium (29 Aug 1988).

Measurements of the intensity, velocity, and angular distribution of positronium emitted from solid samples of metals and insulators have been performed using the intense, pulsed positron beam from the 100 MeV electron linac. From these data it is possible to determine properties of both the surface interactions and volume potentials of the materials studied. Examples of these effects will be given using measurements of positronium time of flight performed with the Livermore intense positron beam. The time of flight data have been augmented by positron lifetime and angular correlation measurements performed with the beam. Measurements resulting in workfunctions, deformation potentials and surface interaction effects will be reported for both metals and insulators. 18 refs., 2 figs.

58042 **Pair connectedness and mean cluster size for continuum-percolation models: Computer-simulation results.** Lee, S.B.; Torquato, S. (Department of Mechanical and Aerospace Engineering, North Carolina State University, Raleigh, North Carolina 27695-7910). *Journal of Chemical Physics;* **89**: No. 10, 6427-6433(15 Nov 1988).

We devise a new algorithm to obtain the pair-connectedness function P(r) for continuum-percolation models from computer simulations. It is shown to converge rapidly to the infinite-system limit, even near the percolation threshold, thus providing accurate estimates of P(r) for a wide range of densities. We specifically consider an interpenetrable-particle model (referred to as the penetrable-concentric-shell model) in which D-dimensional spheres (D = 2 or 3) of diameter σ are distributed with an arbitrary degree of impenetrability parameter λ, $0 \leqq \lambda \leqq 1$. Pairs of particles are taken to be "connected" when the interparticle separation is less than σ. The theoretical results of Xu and Stell for P(r) in the case of fully penetrable spheres ($\lambda = 0$) are shown to be in excellent agreement with our simulations. We also compute the mean cluster size as a function of density and λ for the case of 2D, and, from these data, estimate the respective percolation thresholds.

58043 **Phase transition in the 2D XY model.** Gupta, R.; DeLapp, J.; Batrouni, G.G.; Fox, G.C.; Baillie, C.F.; Apostolakis, J. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review Letters;* **61**: No. 17, 1996-1999(24 Oct 1988).

We present detailed results for the susceptibility chi, correlation length ξ, and specific heat c/sub ν/ for the XY model. The best fit to chi and ξ data is obtained by use of the Kosterlitz-Thouless scaling form with $\nu = 0.500(1)$, but eta shows considerable deviation from (1/4 down to T = 1.03. The critical temperature is estimated to be T/sub c/ = 0.898(2). The simulations are done on 64^2, 128^2, 256^2, and 512^2 lattices with an overrelaxed algorithm which decorrelates as tau≅0.15ξ/sup 1.2/. Similar reduction in critical slowing downs is anticipated for all continuous-spin models.

58044 **Bulk contribution in surface second-harmonic generation.** Guyot-Sionnest, P.; Shen, Y.R. (Department of Physics, University of California, Berkeley, California 94720). *Physical Review* [*Section*] *B: Condensed Matter;* **38**: No. 12, 7985-7989(15 Oct 1988).

We study the bulk contribution to surface second-harmonic generation. It is shown that the formalism in the earlier literature neglected an important term in the bulk contribution which makes the separation of surface and bulk contributions impossible in experiments that allow no modification of the sample. Isotropic and cubic systems media are discussed in some detail for illustration. We also present a model for the bulk nonlinearity of molecular systems.

58045 **Self-interstitial solute complexes in e^--irradiated dilute Al-Ag and Al-Si alloys.** Johnson, E.C.; Granato, A.V. (Department of Physics and Materials Research Laboratory, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801). *Physical Review* [*Section*] *B: Condensed Matter;* **38**: No. 12, 8030-8040(15 Oct 1988).

Ultrasonic attenuation and velocity measurements were performed to probe the structure and annealing behavior of self-interstitial solute complexes in electron-irradiated (T<70 K) dilute Al-

Ag and Al-Si alloys. In both alloy systems, a similar attenuation peak structure is observed. Three peaks are observed to anneal in unison during stage II, suggesting that they arise from the presence of a single defect structure. The annealing of this defect structure follows a first-order rate equation which has a prefactor proportional to the solute concentration. The diaelastic effect associated with this defect is found to be comparable in magnitude and anisotropy to that attributed to <100> self-interstitial dumbbells in pure aluminum. A <110> monoclinic mixed dumbbell model which can account for much of the observed behavior of this defect structure is proposed.

58046 **Photostimulated desorption of negative H^- ions from a cesiated W(100) surface.** Hurych, Z.D.; Soukiassian, P.; Bakshi, M.H.; Bommannavar, A.S.; Young, C.E.; Schweitzer, E.L.; Pellin, M.J.; Gruen, D.M. (Department of Physics, Northern Illinois University, De Kalb, Illinois 60115). *Physical Review [Section] B: Condensed Matter;* **38**: No. 12, 8002-8005(15 Oct 1988).

We report the first experimental observation of negative H^- ions photodesorbed from a cesiated W(100) surface. The kinetic energy of H^- ions is centered at 1 eV. The relatively flat spectral response of the H^- yield in the 30—100-eV photon energy range suggests that the electronic excitations responsible for H^- desorption involve bonding-to-antibonding level transitions and resonant tunneling within the adsorbate-substrate co mplex. Cesiation of the W(100) surface was found to be essential for H^- desorption.

58047 **Effects of isolated atomic collision cascades on SiO_2/Si interfaces studied by scanning tunneling microscopy.** Wilson, I.H.; Zheng, N.J.; Knipping, U.; Tsong, I.S.T. (Department of Physics, Arizona State University, Tempe, Arizona 85287). *Physical Review [Section] B: Condensed Matter;* **38**: No. 12, 8444-8450(15 Oct 1988).

Si(100) wafers with oxide thicknesses of 40 and 200 A were implanted with Ge^+ and As^+ ions with energies from 20 keV to 1 MeV. Low ion doses, {similar←to}10/sup 11/ ions/cm^2, were used to avoid overlap of collision cascades. The extent of cascade damage at the SiO_2/Si interface due to single ion impacts was examined by scanning tunneling microscopy after the oxide layer was removed by HF. The surface topography in the form of craters was found to relate to the cascade damage rather than to the removal of atoms by sputtering. There is a 1:1 correlation between the number of ion impacts and the number of craters. The crater diameter as a function of implant-ion energy agrees well with theoretical estimates of the lateral extent of the cascade due to nuclear energy deposition at the interface.

58048 **Ion sputtering on metal oxides: A source of translationally hot O(^{3}P/sub J/) atoms for chemical studies above 1 eV.** Ferrieri, R.A.; Chu, Y.Y. (Department of Chemistry, Brookhaven National Laboratory, Upton, New York 11973). *Review of Scientific Instruments;* **59**: No. 10, 2177-2184(Oct 1988).

A novel technique is described for generation of translationally "hot" oxygen atoms that can be used for chemical studies. These atoms are produced through ion sputtering on Ta_2O_5 targets. Mass-resolved beams of noble gas ions in the kilovolt energy range are generated for this purpose using a 150-cm isotope separator. The technique can yield fluxes of oxygen atoms in the range of 10/sup 15/ —10/sup 16/ atoms cm/sup -2/ s/sup -1/ from a 40-keV argon ion beam with 15-μA intensity. The sputtered atoms are predominantly neutral and reside exclusively in their ^{3}P/sub J/ ground electronic state upon ejection. Translational energy profiles, measured for an incident ion beam angle of 30° from the surface normal, were found to be similar in both the forward and backward scattered directions at a 60° angle from the surface normal. These distributions peaked at about 7 eV, but extended beyond 20 eV. Theoretical calculations using a modified Thompson model yielded a similar distribution at this angle. This suggests that kilovolt ion sputtering on Ta_2O_5 proceeds predominantly through a collision cascade mechanism. The energy range provided by this technique opens up a new area of hot-atom chemistry for oxygen atoms that has been relatively unexplored until now because of the lack of methods for their generation.

6561 Superconductivity

REFER ALSO TO CITATION(S) 56984, 56985, 56986, 56993, 56994, 56995

58049 **(CONF-8808122—7) Fermi surfaces in YBa_2Cu_3O/sub x/.** Smedskjaer, L.C.; Liu, J.Z.; Benedek, R.; Legnini, D.G.; Lam, D.J.; Claus, H.; Bansil, A. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38;FG02-85ER45223. 4p. NTIS, PC A02/MF A01. Order Number DE89000532/JAW.

From 8. international conference on positron annihilation; Gent, Belgium (29 Aug 1988).

We report 2-D ACAR measurements in both c- and a-axis projections on single crystal YBa_2Cu_3O/sub x/, with oxygen concentrations x {approximately} 7 (T/sub c/ = 93.6 K) and x {approximately} 6.7 (T/sub c/ = 61 K), and a set of Fermi surfaces is proposed for both compositions. We discuss how Fermi-surface signatures may be distinguished from certain prominent features in the 2-D ACAR data unrelated to the Fermi surfaces. 6 refs., 4 figs.

6570 Theoretical And Mathematical Physics

REFER ALSO TO CITATION(S) 56855, 57325, 57783, 57784, 57813, 57891, 57896, 57897, 58313

58050 **(FEI—1830) Combinatory analysis of properties of microcanonical ensemble of systems with arbitrary single-particle spectrum.** Bardychev, D.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1987. 22p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704327/JAW.

Method of generating functions was used to obtain exact expressions for mean occupation numbers, their dispersion and correlation coefficients for microcanonical ensemble of systems with arbitrary single-paricle spectrum. It is shown that these values are expressed in terms of the function, standard for the given spectrum and dictating the total number of configurations in considered ensemble, and depend only on energy and multiplicity of degeneration of corresponding level. Recursion relations are derived for the standard function; they enable one to obtain exact values for a number of configurations of the whole system with fixed value of its total energy and for a number of particles. Bose-, Fermi- and parastatistics are considered as particular cases. 8 refs.

58051 **(IFT-TM—03/85) Processes of relaxation in Lipkin model.** Peixoto, M.F. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1985. 118p. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88703540/JAW.

At first moment, we broach a quantum system interacting with a thermostat using a intuitive way. After that, we use the Zwanzig projection and obtain a "Master'" equation for the reduced statistical operator of the interest system interacting with a reservoir. In order to solve that equation we use the technique of reducing the Liouville space, what results in a set coupled diferential equations - which may be solved analiticaly. Finally, we aply the obtained results to the Lipkin model.

58052 **(IFVE-OTF—88-44) Once more about nonuniqueness of the GRT predictions.** Logunov, A.A.; Loskutov, Yu.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1988. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704345/JAW.

It is shown that the GRT predictions for the gravitational delay of a radiosignal propagating in the field of a static source are nonunique. 5 refs.

58053 **(INIS-BR—1229, pp 48) Semiclassical theory of the electronic transport in metals.** Louzada, J.A.C. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58054 (INIS-BR—1229, pp 59) **Effect of the d f correlation on the electronic structure of intermediate valence systems.** Iglesias, J.R.; Mors, P.M. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58055 (INIS-BR—1229, pp 59) **Real space renormalization of a mixed valence Hamiltonian on a Bethe Lattice.** Mors, P.M.; Simoes, A.S.R.; Iglesias, J.R.; Anda, E.V. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58056 (INIS-BR—1229, pp 59) **Effect of the d f Coulomb correlation on the valence transition of intermediate valence systems.** Iglesias, J.R.; Mors, P.M. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58057 (INIS-BR—1229, pp 61) **New approach to the study of an Anderson impurity in a linear chain.** Simoes, A.S.R.; Iglesias, J.R. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58058 (INIS-BR—1229, pp 63) **Conductivity of a random electron chain renormalization group approach.** Theumann, A. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58059 (INIS-BR—1229, pp 64) **Superalgebra and the spherical model of a spin glass.** Theumann, A. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58060 (INIS-BR—1229, pp 64) **Simple approximation for the Bethe-Ansatz solution of the one-dimensional Fermigas.** Gusmao, M.A.C. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58061 (INIS-BR—1229, pp 65) **Spherical model as the limiting n-vector model in a random field.** Theumann, W.K.; Fontanari, J.F. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58062 (INIS-BR—1229, pp 67) **Diagramatic solution of the Kondo lattice.** Simoes, A.S.R.; Iglesias, J.R.; Rojo, A.; Alascio, B.R. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Comision Nacional de Energia Atomica, San Carlos de Bariloche (Argentina). Centro Atomico Bariloche). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58063 (INIS-BR—1229, pp 68) **Localization properties in binary alloys described by a Bethe lattice.** Huebler, R.; Teixeira, R.M.R.; Strauch, I.M. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58064 (INIS-BR—1229, pp 70) **Study of the Hubbard Hamiltonian and intermediate valence systems on the Bethe lattice.** Mors, P.M. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58065 (INIS-BR—1229, pp 70) **Diagramatic solutions of an intermediate valence Hamiltonian and Kondo lattice.** Simoes, A.S.R. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58066 (INIS-BR—1229, pp 84) **Rational functions of momentum as invariants for one-dimensional time-dependent potentials: two-and three-resonance cases.** Lewis, H.R.; Goedert, J. (Los Alamos National Lab., NM (USA)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58067 (INIS-SU—49, pp 25-30) **Numerical study of stability of vector U(2)-solitons.** Makhan'kov, V.G.; Kholmurodov, Kh.T. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation; Tadzhikskij Gosudarstvennyj Univ., Dushanbe (USSR)). 1987. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89780012/JAW.

Preprint 5(25)-87.

In JINR rapid communications. Collection.

The stability of one- and two-solutions of vector Schroedinger equation with a compact group U(2) of internal symmetry is investigated, The computational experiment has shown that the N=1 vector soliton ("shallow pit") is stable with respect to initial excitaions made by computer and structural excitations connected with descretization of the model. The N=2 vector soliton ("deep pit") is unstable, moreover, the speed of his decay on two scalar N=1 solitons depends on both a soliton amplitude and a lattice step. The latter points to the structural character of unsteadiness. 6 refs.; 3 figs.; 2 tabs.

58068 (ITEF—5(1988)) **Types of test particle finite motions in the Kerr metric.** Zakharov, A.F. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1988. 21p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704359/JAW.

Possible types of particle finite motions in the Kerr metric are considered. Topology of particle motion constant sets determining different types of motion is determined. Invariants not depending on the parameter of black hole rotation are found. 17 refs.; 10 figs.

58069 (ITEF—216(1987)) **Spin precession in a weak gravitational field.** Voronov, N.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 11p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704364/JAW.

Previously developed technique for calculating spin precession velocity in Schwarzschild field was applied for the case of arbitrary weak gravitational field. The obtained expression for precession velocity in limiting cases (nonrelativistic particle velocity and in post-Newton approximation) coincides with earlier known formulae. If v test particle velocity tends to 1, we obtain the expression for precession velocity of photon polarization vector, which contains the summand describing the rotation of photon polarization plane. 8 refs.

58070 (ITEP—209(1987)) **On the experimental basis of the Pauli exclusive principle.** Okun, L.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704366/JAW.

The paper proposes and advocates quantitative tests of the Pauli principle in atoms using modern experimental techniques. At the same time it reminds and illustrates why it is so difficult to violate the Pauli principle on paper, in the framework of accepted fundamental theoretical ideas. 26 refs.

58071 (ITP—87-33) Relativistically-invariant statistical hydrodynamics of a normal fluid. Panferov, A.D.; Sinyukov, Yu.M.; Smolyanskij, S.A. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1987. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704370/JAW.

Quasi-equilibrium statistical operators related to arbitrary space-like hypersurfaces are constructed for a normal relativistical fluid. The conditions under which local thermodynamic quantities are invariant with any choice of a hypersurface are found. The compatibility conditions for a quasi-equilibrium and a nonequilibrium description are obtained. The method of calculating the transport coefficients in demonstrated for the model of a relativistic self-interacting scalar field. 19 refs.

58072 (JINR-R—2-87-812) Formation length and relativistic length. Strel'tsov, V.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704385/JAW.

A possible connection of formation length with relativistic length is pointed to. Namely, growth of formation length with increasing energy is in accordance with the /sup e/longation formula/sup f/or longitudinal dimensions following from the concept of relativistic length. It is noted that taking into account the finiteness of dimensions of elementary particles the formation length couldn be in fact determined by relativistic length. 6 refs.; 1 fig.

58073 (JINR-R—2-87-817) Concept of relativistic length and its applications. Strel'tsov, V.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. 11p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704386/JAW.

A short review of papers dealing with the concept of relativistic length (CRL) its two modifications and their applications in classical physics is presented. Graphic geometrical interpretation of CRL is given. It is noted that CRL is essentially a component of relativistic electrodynamics. Application of CRL permits to solve a number of the known 'paradoxes' of special relativity and to avoid difficulties of relativization of different sections of classical physics. Within its limits the known experiments of Michelson-Morley, Trauton-Noble a.o. could be succesively interpreted. 30 refs.; 2 figs.

58074 (KFKI—1988-38/A) Landau's density matrix in quantum-electrodynamics. Diosi, L. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). 1988. 16p. (CONF-8806240—1). NTIS (US Sales Only), PC A03. Order Number DE88016024/JAW.

From Landau memorial conference on frontiers of physics; Tel Aviv, Israel (6 Jun 1988).

This paper is devoted to Landau's concept on the problem of damping in the quantum mechanics. It shows that Landau's density matrix formalism should survive in the context of modern quantum- electrodynamics. The correct generalized master equation has been derived for the reduced dynamics of the charges. Recent relativistic theory of spontaneous emission becomes reproducible. 11 refs.

58075 (LA-UR—88-2823) A direct iterative-variational method for solving large sets of linear algebraic equations. Schneider, B.I.; Collins, L.A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 20p. (CONF-8810119—3). NTIS, PC A03/MF A01. Order Number DE88016149/JAW.

From Workshop on practical iterative methods for large scale computations; Minneapolis, MN, USA (23 Oct 1988).

We have developed a direct iterative-variational technique for solving large systems of linear equations: $Ax = b$, where N is the order of the matrix A and the length of the vectors x and b. The method, which has analogues in the conjugate gradient and Lanczos schemes as well as the direct configuration interaction procedures of quantum chemistry, involves the construction of an orthonormal basis from successive applications of the general linear algebraic (LA) matrix, A, to an initial guess for the solution vector. The solution vector is expanded in this basis, and the coefficients are determined from a variational prescription. For n iterations, the number of operations to solve the LA equations is of the order N^2n. Since the basis is orthonormal, the procedure is guaranteed to converge within N iterations, provided that the basis vectors remain linearly independent. In practice, the convergence is much more rapid ($n << N$). Another advantage of the method is that the whole matrix A need not be stored. In the more general case of multiple right-hand-sides (x and b, matrices), the method can be applied simultaneously to all of the solutions, thus saving many redundant operations that would arise from treating each column of x independently. We have applied the technique to the solution of LA systems that arise from converting radial coupled integrodifferential equations to an integral representation on a discrete quadrature, in particular, to a variety of problems for electron-atom and -molecule collisions. 21 refs.

58076 (LA-UR—88-2896) Hard core perturbation theory. Silver, R.N. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 11p. (CONF-8808136—1). NTIS, PC A03/MF A01. Order Number DE89000384/JAW.

From Condensed matter theories; Taxco, Mexico (14 Aug 1988).

A novel perturbative expansion of the dynamic susceptibility about the ground state wave function is proposed. The method uses Liouville perturbation expansions, the Hubbard-Stratonovich transformation of the Hamiltonian with fictitious bosons, projection super-operators and super-duper-operators. The method is especially applicable to the dynamical susceptibility of strongly-interacting systems, where ground state correlation functions and density matrices are available from calculations or experiments. To illustrate the method, the final state corrections to the impulse approximation are derived for high momentum transfer neutron scattering. 18 refs., 3 figs.

58077 (LA-UR—88-2988) Dynamics of unbound vortices in the 2-dimensional XY and anisotropic Heisenberg models. Mertens, F.G.; Bishop, A.R.; Gouvea, M.E.; Wysin, G.M. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 11p. (CONF-880705—9). NTIS, PC A03/MF A01. Order Number DE89000371/JAW.

From International conference on magnetism; Paris, France (25 Jul 1988).

Assuming an ideal gas of vortices above the Kosterlitz-Thouless transition temperature, the dynamic form factors are calculated. For the in-plane correlations a Lorentzian central peak is predicted which is independent of the vortex size and shape. However, for the out-of-plane correlations the velocity dependence of the vortex structure is decisive for the occurrence of a Gaussian central peak. Both results are in good agreement with combined Monte Carlo-molecular dynamics simulations. 8 refs., 1 fig.

58078 (LBL—25615) Progress in high-resolution x-ray holographic microscopy. Jacobsen, C.; Kirz, J.; Howells, M.; McQuaid, K.; Rothman, S.; Feder, R.; Sayre, D. (Lawrence Berkeley Lab., CA (USA)). Jul 1987. Contract AC03-76SF00098;AC02-76CH00016. 11p. (CONF-8708180—14). NTIS, PC A03/MF A01. Order Number DE88016623/JAW.

From Symposium on X-ray microscopy; Upton, NY, USA (31 Aug 1987).

Among the various types of x-ray microscopes that have been demonstrated, the holographic microscope has had the largest gap between promise and performance. The difficulties of fabricating x-ray optical elements have led some to view holography as the most attractive method for obtaining the ultimate in high resolution x-ray micrographs; however, we know of no investigations prior to 1987 that clearly demonstrated submicron resolution in reconstructed images. Previous efforts suffered from problems such as limited resolution and dynamic range in the recording media, low coherent x-ray flux, and aberrations and diffraction limits in visible light reconstruction. We have addressed the recording limitations through the use of an undulator x-ray source and high-resolution photoresist recording media. For improved results in the readout and reconstruction steps, we have employed metal shadowing and transmission electron microscopy, along with numerical reconstruction techniques. We believe that this approach will allow holography to

emerge as a practical method of high-resolution x-ray microscopy. 30 refs., 4 figs.

58079 **(NBI-HE—88-28) Recent progress in the theory of noncritical strings.** Kazakov, V.A.; Migdal, A.A. (Niels Bohr Inst., Copenhagen (Denmark); AN SSSR, Moscow. Cybernetics Council). (Niels Bohr Inst., Copenhagen (Denmark); Niels Bohr Inst., Copenhagen (Denmark)). May 1988. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755198/JAW.

We compare the results of analytical and numerical study of lattice 2D quantum gravity, where the internal quantum metric is described by random (dynamical) triangulation, with recent results of conformal approach developed by Knizhnik, Polyakov and Zamolodchikov. The remarkable agreement is underlined for the interactions of gravity with matter fields: Potts spins, D-dimensional Gaussian fields (bosonic string). Some new results are presented for D=1 discretized bosonic string satisfying the predictions of conformal theory for the critical exponents: γ/sub str/ = 0, ν/sub str/ = 0, but with unusual logarithmic corrections.

58080 **(NORDITA—86/1(prepr.)) Spin-reversed quasiparticles in the fractional quantum Hall effect - many-body approach.** Chakraborty, T. (Oulu Univ. (Finland). Dept. of Theoretical Physics). (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Oulu Univ. (Finland). Dept. of Theoretical Physics). Feb 1986. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755256/JAW.

The elementary excitations at 1/3 Landau-level filling have been studied in the many-body variational approach. In the absence of Zeeman energy, the lowest energy excitations involve spin-reversed quasiparticles. The proper excitation energies including the finite thickness correction have been presented for the spin-reversed quasiparticles and the spin-polarized quasiholes.

58081 **(NORDITA—88/14-P(prepr.)) On 2D (super) gravity in the light-cone gauge.** Grundberg, J.; Nakayama, R. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). Mar 1988. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755267/JAW.

We derive the light-cone gauge formulation of 2D gravity recently discussed by Polyakov in a way which relates it to the conformal gauge. This formulation is extended to (1,1) supergravity.

58082 **(SAND—88-1597C) CTH: A three-dimensional large deformation, strong shock wave physics code.** McGlaun, J.M.; Thompson, S.L.; Elrick, M.G. (Sandia National Labs., Albuquerque, NM (USA)). [1988]. Contract AC04-76DP00789. 10p. (CONF-881093—3). NTIS, PC A02/MF A01. Order Number DE89001185/JAW.

From Nuclear explosives code developer's conference; Boulder, CO, USA (11 Oct 1988).

CTH is a software system under development at Sandia National Laboratories Albuquerque to model multidimensional, multimaterial, large deformation, strong shock wave physics. One-dimensional, two-dimensional, and three-dimensional Eulerian meshes are currently available. CTH uses tabular or analytic equations of state that model solid, liquid, vapor, plasma, and mixed-phase materials. CTH can model elastic-plastic behavior, high explosives, fracture, and motion of fragments smaller than a computational cell. CTH was carefully structured to vectorize and multitask on the CRAY X-MP. Three-dimensional databases reside on the CRAY solid state disk with only five planes in core at once. The input/output to the solid state disk is overlapped with computations so there is no penalty for using the solid state disk. This allows very large problems to be run effectively. A sophisticated post-processor, CTHED, has been developed for interactive analysis using color graphics. This paper describes the architecture, database structure, models, and novel features of CTH. Special emphasis will be place on the features that are novel to CTH or are not direct generalizations of two-dimensional models. 8 refs., 1 fig.

58083 **(SAND—88-1598C) Multitasking the three-dimensional shock wave code CTH on the Cray X-MP/416.** McGlaun, J.M.; Thompson, S.L. (Sandia National Labs., Albuquerque, NM (USA)). [1988]. Contract AC04-76DP00789. 15p. (CONF-881093—4). NTIS, PC A03/MF A01. Order Number DE89001186/JAW.

From Nuclear explosives code developer's conference; Boulder, CO, USA (11 Oct 1988).

CTH is a software system under development at Sandia National Laboratories Albuquerque that models multidimensional, multi-material, large-deformation, strong shock wave physics. CTH was carefully designed to both vectorize and multitask on the Cray X-MP/416. All of the physics routines are vectorized except the thermodynamics and the interface tracer. All of the physics routines are multitasked except the boundary conditions. The Los Alamos National Laboratory multitasking library was used for the multitasking. The resulting code is easy to maintain, easy to understand, gives the same answers as the unitasked code, and achieves a measured speedup of approximately 3.5 on the four cpu Cray. This document discusses the design, prototyping, development, and debugging of CTH. It also covers the architecture features of CTH that enhances multitasking, granularity of the tasks, and synchronization of tasks. The utility of system software and utilities such as simulators and interactive debuggers are also discussed. 5 refs., 7 tabs.

58084 **(UCRL—98561) Dynamics of structures: Solution techniques.** Engelmann, B.E. (Lawrence Livermore National Lab., CA (USA)). Apr 1988. Contract W-7405-ENG-48. 18p. (CONF-8808124—2). NTIS, PC A03/MF A01. Order Number DE88017022/JAW.

From Advanced study institute on finite element analysis; Madras, India (1 Aug 1988).

The increased use of large scale dynamic simulations in various engineering applications is apparent and time integration plays an important role. The use of direct time integration as a solution procedure for finite element semidiscretizations may be advantageous for linear systems, but finds an even greater application in nonlinear analyses. The characteristics of the time integration procedure can have a critical impact on the feasibility of the calculation. The wrong choice of time integrator could be impractical or lead to excessive errors in the simulation. For these reasons, direct time integration has continued to be an active area of research. In this paper, the fundamentals of time integration as well as specific new developments in the area are discussed. The methodologies are presented in a linear setting, but topics related to nonlinear analyses are considered. The primary focus is on the solution of the equations of motion arising in structural dynamics. These are a coupled set of second order, ordinary differential equations resulting from the semidiscretization of the governing hyperbolic partial differential equations. However, much insight on time integration procedures can be gained by studying first order systems due to their simplicity. These systems arise from a semidiscretization of the diffusion equations such as transient heat conduction and are of the parabolic type. The fundamental aspects of time integration are first shown in the context of first order systems. The integration of the equations of motion as well as some guidelines for choosing a particular solution method are discussed. Advances in the field including numerically dissipative algorithms and partitioned time integration procedures are also presented. 33 refs.

58085 **(UCRL—98562) Dynamics of structures: Fundamentals.** Engelmann, B.E. (Lawrence Livermore National Lab., CA (USA)). Apr 1988. Contract W-7405-ENG-48. 16p. (CONF-8808124—1). NTIS, PC A03/MF A01. Order Number DE88017027/JAW.

From Advanced study institute on finite element analysis; Madras, India (1 Aug 1988).

With the rapid development of more efficient computer hardware and software, dynamic nonlinear numerical simulations are now within the realm of many engineering analyses. As a result, considerable effort has been directed toward the area of structural dynamics. Many new approaches and solution strategies have been proposed to increase the accuracy and efficiency of simulations. The most common approach to structural dynamics is one in which the spatial discretization and temporal solution are performed inde-

pendently. This is called a semidiscretization. The governing partial differential equations are first discretized in space, yielding a coupled system of ordinary differential equations. A variety of methods may then be used to integrate this system of ordinary differential equations in time. This paper concentrates on developing the equations of structural dynamics, known as the discrete equations of motion, rather than on the solution of these equations. Although most of the following developments are done in a linear context, some references are made to nonlinear analysis. First, an example of the semidiscretization accomplished through the finite element method is shown for a multidimensional linear continuum. Modal analysis and special properties of the resulting discrete equations of motion are shown. Structural damping is discussed, and various forms of the mass matrix are given. 10 refs.

58086 **Resource Letter FR-1: Fractals.** Hurd, A.J. (Chemical Physics Division 1152, Sandia National Laboratories, Albuquerque, New Mexico 87185). *American Journal of Physics;* **56**: No. 11, 969-975(Nov 1988).

This Resource Letter provides a guide to the literature on fractals. Although "fractal" is a relatively new term in science, unifying many new ideas with established ones, its wide application and general popularity have made it one of the fastest growing fields in statistical physics. The letter E after an item indicates elementary level or material of general interest to persons becoming informed in the field; the letter I, for intermediate level, indicates material of somewhat more specialized nature; and the letter A indicates rather specialized or advanced material. An asterisk (*) indicates those articles to be included in an accompanying Reprint Book.

58087 **Direct solution for the power spectrum of the Lorenz attractor.** Andrews, P.L.; Waltz, R.E. (General Atomics, San Diego, California 92138-5608). *Physics of Fluids;* **31**: No. 11, 3168-3170(Nov 1988).

A novel method is applied to the Lorenz system that deals directly with the power spectrum of the turbulent solutions. Analytic predictions are produced as to the level of turbulence and the spread in frequency space of the solution that are in good agreement with numerical computations. The method involves manipulation of the Fourier transformed Lorenz equations and their tempered distribution solutions.

58088 **Reaction probability for sequential separatrix crossings.** Cary, J.R.; Skodje, R.T. (Department of Astrophysical, Planetary and Atmospheric Sciences 9-0391 Department of Physics, University of Colorado, Boulder, Colorado 80309-0391). *Physical Review Letters;* **61**: No. 16, 1795-1798(17 Oct 1988).

The change of the crossing parameter (essentially the phase) between sequential slow separatrix crossings is calculated for Hamiltonian systems with one degree of freedom. Combined with the previous separatrix crossing analysis, these results reduce the dynamics of adiabatic systems with separatrices to a map. This map determines whether a trajectory leaving a given separatrix lobe is ultimately captured by the other lobe. Averaging these results over initial phase yields the reaction probability, which does not asymptote to the fully phase-mixed result even for arbitrarily long times between separatrix crossings.

58089 **Symmetry behavior in cosmological spacetimes: Effect of slowly varying background fields.** Sinha, S.; Hu, B.L. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 8, 2423-2433(15 Oct 1988).

For the investigation of the possibility of symmetry breaking and restoration arising from the dynamics of background field and geometry, we have analyzed the case of a self-interacting scalar field in a spatially flat Robertson-Walker universe under the quasi-local approximation on the background field. The effective mass receives contributions from the temporal variations of the background field and curvature both classically and with quantum radiative corrections, indicating that the dynamics of the background can affect the symmetry behavior of the system.

58090 **Invariant tori for two-dimensional non-integrable Hamiltonians.** de Aguiar, M.A.M.; Baranger, M. (Center for Theoretical Physics, Laboratory for Nuclear Science, and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Annals of Physics (New York);* **186**: No. 2, 355-380(Sep 1988).

The invariant tori of a two-dimensional non-integrable Hamiltonian form families which can be parametrized by the energy and the rotation number. Within each family, the variation with energy is continuous, and the variation with rotation number is governed by the KAM theorem and is everywhere discontinuous. In order to calculate the tori numerically, we approximate them by highly winding periodic orbits, and we give a criterion for the validity of this approximation. For one particular Hamiltonian, we study the family of tori which connects two distinct families of periodic trajectories. As a by-product of this calculation, we draw the curve bounding the "mostly regular" region, on a plot whose coordinates are the two partial periods of the tori. copyright 1988 Academic Press, Inc.

58091 **Calculation of periodic trajectories.** Baranger, M.; Davies, K.T.R.; Mahoney, J.H. (Center for Theoretical Physics, Laboratory for Nuclear Science, and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Annals of Physics (New York);* **186**: No. 1, 95-[illegible]00(15 Aug 1988).

Methods are presented for calculating classical periodic trajectories in a two-dimensional non-integrable potential problem. The main one is the monodromy method, which consists in refining an approximate solution by using a "once-around-the-trajectory" procedure. This can be done either for a given period or for a given energy. Other methods proceed by searching on the initial conditions until the trajectory closes. We also discuss how to find new periodic families, particularly branchings from already known families, and how to get started when no families are known.

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58092 **(AD-A—195396/7/XAB) Simple one-dimensional, one-fluid divertor model. Final report.** Baehre, M.D. (Army Military Personnel Center, Alexandria, VA (USA)). 20 May 1988. 349p. NTIS, PC A15/MF A01.

This thesis presents the development of a simple and comprehensive model of the divertor region of a fusion reactor that can be implemented on a PC to make it highly usable and user-friendly. The model includes the critical processes of; neutral recycling, impurity production and radiation, remote radiative cooling, neutral pumping, particle convection, ash effects, and the effects of divertor geometry and plate material. A set of fluid equations is solved for the plate temperature and density, and the throat temperature, using a fixed-point iteration routine, and gauss-seidel updating. Neutral-Particle modeling is accomplished with a simple model of a wedge-shaped section of plasma overlying the divertor plate and a simple slab attenuation model. The results of benchmarking the model developed in this thesis against four other divertor models was very successful and validates the approach taken.

58093 **(ANU-PRL-PP—88/1) Experimental investigation of different configurations in a flexible heliac.** Shi, X.H.; Hamberger, S.M.; Blackwell, B.D. (Australian National Univ., Canberra. Plasma Research Lab.). 1988. 31p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703952/JAW.

The effect of varying the magnetic configuration by adding an l = 1 helical winding to a standard heliac has been studied experimentally. Equilibrium plasma configurations are obtained in the range 0.7 ≦ zeta(0) ≦ 1.86. Analysis of the plasma pressure profiles measured by Langmuir probes in this range all show good agreement between the plasma isobars and the computed vacuum magnetic surfaces; for configuration with zeta(0) close to unity it is

necessary to take a known error fields into account. The deterioration of the plasma confinement when low-order rational surfaces are present is clearly observed, and the magnetic islands which result from the resonance between the low-order rational surface zeta=3/2, and the m=2,n=3 vacuum field harmonics inherent in the geometry are identified with features observed in both the plasma pressure and the floating potential profiles.

58094 **(ANU-PRL-TR—87/2) Energy of runaway electrons in the LT-4 tokamak.** Morton, A.H. (Australian National Univ., Canberra. Plasma Research Lab.). Aug 1987. 21p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703953/JAW.

This report describes measurements which have been made on LT-4, using calibrated X-ray detectors, to determine the energy of runaway electrons striking the limiter. The detectors were Teledyne NaI(Tl) Integral (S-68-I). The detectors were wrapped in three layers of Metshield. Calibration of the detectors was carried out at the AAEC, Lucas Heights, using the AINSE 1.3 (nominal) Mev Van De Graaff electron accelerator. The calibration is discussed in section 2. In section 3, the results of the measurements made with LT-4 are presented.

58095 **(CONF-881015—9) A model for the L-H transition in tokamaks.** Shaing, K.C.; Lee, G.S.; Carreras, B.A.; Houlberg, W.A.; Crume, E.C. Jr. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01. Order Number DE88016791/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

Fluctuation-driven transport fluxes in the plateau regime are calculated with the methodology of neoclassical transport theory. Particle and heat fluxes are the most sensitive to fluctuations; the modification to plasma resistivity is the least sensitive. The fluctuation-driven bootstrap current and Ware pinch flux are moderately sensitive and depend on the radial mode structure. One of the thermodynamic forces depends on the radial electric field E/sub r/. Changing E/sub r/ can change the fluctuation spectrum and thus the transport fluxes. The effects of E/sub r/ on the fluctuation spectrum are caused by the radial shear of the angular velocity, which is proportional to E/sub r//r. Studies of the dynamic evolution and the saturation of MHD turbulence under the influence of E/sub r/ show that the saturation amplitudes are lower and the confinement is thus better for a more negative value of E/sub r/. A proposed model for the L-H transition is based on the improved confinement with more negative E/sub r/. A scaling for the power threshold P/sub th/ is P/sub th/ α $N^3q/(I/sub\ p/^2M/sub\ i/)$, with the N plasma density, q the safety factor, I/sub p/ the plasma current, and M/sub i/ the ion mass. 14 refs., 2 figs.

58096 **(CONF-881031—7) The technology of the ion cyclotron range of frequencies.** Hoffman, D.J.; Barber, G.C. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 17p. NTIS, PC A03/MF A01. Order Number DE88016809/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

Plasma heating in the ion cyclotron range of frequencies (ICRF) is the least expensive means of accomplishing auxiliary heating in fusion experiments. RF systems comprise two major elements: the transmitter and the antenna. The state of the art for the transmitter is already at the megawatt level. The technology of the antenna is strongly coupled to the plasma character. Typically, these antennas are designed to operate at a high power density (1.2 kW/cm^2) with an efficiency of 96%. ICRF technology and options have improved over the past few years, owing to development and experiments; however, the optimal combination of options can be defined only when results from confinement experiments and test facilities are in hand. 19 refs., 5 figs., 1 tab.

58097 **(DOE/ET/53088—335) Relation between beam driven seed-current and rotation in steady state FRC.** Okamoto, M.; Berk, H.L.; Hammer, J.H. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Sep 1988. Contract FG05-80ET53088. 33p. (IFSR—335). NTIS, PC A03/MF A01. Order Number DE89000022/JAW.

We consider an field steady state reversed configuration whose current is maintained by a steady state beam. Without quadrupole fields, back current can be inhibited by the Ohkawa effect if Z/sub b/ < Z/sub eff/, where Z/sub b/ and Z/sub eff/ are the beam charge number and effective charge number of background ions. However, the resulting rotation of the plasma often leads to instability. For systems, with a large bootstrap effect, the rotation can be moderate, but it is then difficult to contain fusion products. An additional problem is that the Ohkawa effect due to alpha particles tends to dissemble the equilibrium. It has previously been shown that the presence of a quadrupole field inhibit back current. Here we show that a steady state flux can be maintained with moderate input power in both reactors and present day experiments with the resulting rotation slow enough to fulfill stability conditions. However, experimental means must be devised to supply a continual source of particles and additional energy. 17 refs., 3 figs.

58098 **(DOE/ET/53088—343) Diffusive processes in the cross-field flow of intense plasma beams.** Newberger, B.; Rostoker, N. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Sep 1988. Contract FG05-80ET53088. 19p. (IFSR—343). NTIS, PC A03/MF A01. Order Number DE89001454/JAW.

We consider magnetic field diffusion in the presence of strongly magnetized electrons (ω/sub ce/{tau}/sub co/ > 1) as a mechanism for the rapid field penetration observed in cross-field flows of high-β plasma beams. The diffusion has been investigated in several cases which are amenable to analytic solution. The flux penetration times are found to be insensitive to the particular configuration. Comparison with two experiments is made. Agreement within the limits of the experiments is found. Both require an anomalous collision rate which is consistent with observed fluctuations in one case but apparently not the other. 17 refs., 1 fig.

58099 **(DOE/ET/53088—344) The quasi-interchange mode as a mechanism for fast sawtooth crashes.** Waelebroeck, F. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Dec 1988. Contract FG05-80ET53088. 126p. (IFSR—344). NTIS, PC A07/MF A01. Order Number DE89001450/JAW.

It has been suggested that the recently observed fast sawtooth crashes are caused by a low-shear, pressure-driven ideal instability. This hypothesis is investigated, using asymptotic methods to solve the toroidal mode equations for a class of equilibria characterized by a low-shear central region in which q-1 is small, separated from the wall by a region with finite shear. A dispersion relation which differs significantly from previous results is obtained. The new instability displays no threshold with regard to the poloidal beta. An explicit expression for the growth rate is given for a model q profile. The linear growth rates are found to rise steeply near marginal stability but not sufficiently so as to account for the rapid onset of growth observed in the experiments. The nonlinear corrections to the mode growth are evaluated to lowest order in the amplitude, using a low-beta expansion of the reduced Magnetohydrodynamic equations. These equations are shown to be identical to the full Magnetohydrodynamic equations in the linear regime except for the neglect of parallel kinetic energy and the effects of compressibility. The calculation differs from previous bifurcation analyses by the inclusion of toroidal curvature effects including coupling to non-resonant harmonics. The nonlinear forces are found to be stabilizing bifurcated equilibria above marginal stability. In this respect our conclusions resemble those for the zero-beta, free-boundary kink. The amplitude of the bifurcated equilibria, however, is found to be much larger than those for the fixed-boundary, finite-shear kink. 78 refs., 15 figs.

58100 **(DOE/ET/53088—346) MHD Alfven stability in ignited toroidal plasmas.** Fu, G.Y.; Van Dam, J.W.; Rosenbluth, M.N.; Ross, D.W.; Zhang, Y.Z.; Berk, H.L.; Mahajan, S.M.; Cheng, C.Z.; Miller, R.L.; Wang, X.H. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Oct 1988. Contract FG05-80ET53088. 17p. (IFSR—346). NTIS, PC A03/MF A01. Order Number TI89001071/JAW.

The presence of fusion-product alpha particles in an ignition tokamak can significantly modify the stability behavior of the burn-

ing plasma. In this paper, the effects of toroidicity are retained in a theoretical description of two global-type shear Alfven modes that can be destabilized by the alpha particles. Toroidicity can lead to stabilization of the global shear Alfven eigenmode, but it induces a shear Alfven gap eigenmode whose growth rate is even larger, although these modes may saturate nonlinearly. The stabilizing influence of highly energetic particles on low-frequency MHD ballooning and internal kink modes is also explored; in particular, ion diamagnetic frequency effects may stabilize fishbone oscillations, as has been observed with monster sawteeth in JET with ICRF heating. 10 refs., 3 figs.

58101 **(DOE/ET/53088—347) Particle simulation of toroidicity-induced drift modes.** LeBrun, M.J.; Tajima, T. (Texas Univ., Austin (USA)). Oct 1988. Contract FG05-80ET53088. 17p. (IFSR—347). NTIS, PC A03/MF A01. Order Number DE89001070/JAW.

The linear and nonlinear behavior of the toroidicity induced drift mode is studied using a three dimensional, natural coordinate electrostatic particle code. In this simulation an instability involving radially extended toroidal drift modes, showing a banded frequency structure, is observed for the first time. Nonlinear phenomena such as the enhancement of instability by toroidal mode multiplicity, saturation, and particle transport are also reported. 13 refs., 4 figs.

58102 **(GA—A-19393) Toroidal pinch experiments in OHTE with a resistive shell.** Tamano, T.; Bard, W.D.; Greenfield, C.M.; La Haye, R.J.; Schaffer, M.J.; Taylor, P.L. (General Atomics Co., San Diego, CA (USA)). Sep 1988. Contract AC03-84ER53158;FG03-86ER53228. 9p. (CONF-881015—14; IAEA-CN—50/C-2-3). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE88017339/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

Reversed field pinch (RFP) experiments (edge safety factor q/sub edge/ < 0) and ultra low q (ULQ) experiments ($0 <$ q/sub edge/ < 1) were carried out in OHTE with a resistive shell. In the RFP experiments, active control of plasma equilibrium position greatly improved the reproducibility of discharges sustained over 10 ms. However, onset of simultaneous m = 0 and 1, toroidally localized, locked MHD modes often caused discharge termination. Their amplitudes seem to increase with β. ULQ discharges were sustained for up to 28 ms. The plasma exhibited a marked tendency toward constant current operation at favored q, suggesting plasma self-organization. The first ULQ discharges to break the radiation barrier are reported. 1 ref., 3 figs.

58103 **(GA-A—19374) Energy and particle transport across a separatrix in diverted tokamaks.** Hinton, F.L.; Staebler, G.M. (General Atomics Co., San Diego, CA (USA)). Aug 1988. Contract AC03-84ER53158. 10p. (CONF-881015—3). NTIS, PC A02/MF A01. Order Number DE88014951/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

Transport across a separatrix is shown to be significantly modified by poloidal gradients, which result from the flow of particles and heat along field lines toward the divertor region. The theory predicts an inward contribution to the particle flux, and a corresponding inward contribution to the convective energy flux, when the ion grad-B drift is toward the x-point, in a single-null configuration. This is due to a classical thermoelectric potential which exists near the separatrix when heat is conducted classically along magnetic field lines towards the x-point region. The magnetic surface-averaged classical (diamagnetic and E x B) radial particle flux is inward, when the x-point is correctly located. Estimates of the size of this particle flux indicate that it may be contributing significantly to the H-mode density rise just inside the separatrix in DIII-D. Estimates of the effect on the energy flux give values for the ratio of H-mode power thresholds, with two different grad-B drift directions, which agree approximately with the experimental results. 8 refs., 1 fig.

58104 **(GA-A—19444) Stability of high beta discharges in the DIII-D tokamak.** Strait, E.J.; Lao, L.L.; Taylor, T.S.; Chu, M.S.; Lee, J.K.; Turnbull, A.D.; Allen, S.L.; Brooks, N.H.; Burrell, K.H.; Callis, R.W. (General Atomics Co., San Diego, CA (USA)). Oct 1988. Contract AC03-84ER51044. 15p. (CONF-881015—24). NTIS, PC A03/MF A01. Order Number DE89001434/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

An operational beta limit of $\beta \leqq 3.5$ I/aB has been encountered in neutral beam heated H-mode divertor discharges in DIII-D, scaling linearly with I/aB over a factor of 3 in I/aB and beta. Carefully prepared discharges have run stably very close to this limit, with $\beta \geqq 3$ I/aB having been sustained for more than 1 second. The maximum beta in such discharges is limited by hard disruptions which are attributed to the ideal 2/1 kink mode. Before reaching this limit, most discharges experience a saturation or slow collapse of beta associated with low-n MHD instabilities which are consistent with stability calculations for resistive pressure-driven modes. As beta increases, MHD instabilities appear in part or all of a sequence having mode numbers m/n = 5/4, 4/3, 3/2, and 2/1. The n = 2 mode is associated with a moderate degradation of confinement, while the n = 1 mode causes a complete loss of plasma energy and disruption of the discharge. The observed beta limit is well below the maximum beta allowed by ideal high-n ballooning modes for optimized profiles, but the pressure gradient at the center and edge of the discharge is calculated to be near the marginally stable value, and ballooning modes may influence the pressure profile in these regions. The maximum beta reached to date, 6.8%, occurred in a discharge which was well away from both predicted and operational beta limits and ran stably with $\beta > 6\%$ for 800 msec. 16 refs., 6 figs.

58105 **(GA-A—19447) DIII-D neutral beam current drive experiments at high beta poloidal.** Simonen, T.C.; Matsuoka, M.; Bhadra, D.K.; Chance, M.S.; Burrell, K.H.; Callis, R.W.; Chu, M.S.; Colleraine, A.P.; Ferron, J.R.; Greene, J.M. (General Atomics Co., San Diego, CA (USA)). Oct 1988. Contract AC03-84ER51044. 12p. (CONF-881015—21). NTIS, PC A03/MF A01. Order Number DE89001440/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

Neutral beam current drive experiments in the DIII-D divertor tokamak are described. Plasma currents up to 0.34 MA has been sustained by neutral beams alone with H-mode quality energy confinement. Poloidal beta values reach β/sub P/ = 3.5 without disruption or coherent magnetic activity, suggesting that these plasmas may be entering the second stability regime. At such high β/sub P/ the trapped particle averaged toroidal drift is reversed over half of the plasma. In these experiments we observe helicity, but not flux, conservation. 29 refs., 8 figs.

58106 **(GA-A—19448) Electron cyclotron heating experiments in the DIII-D tokamak.** Prater, R.; Brooks, N.H.; Burrell, K.H.; Carlstrom, T.N.; Chance, M.S.; Chu, M.S.; Content, D.; DeBoo, J.C.; Edlington, T.; Ferron, J.R. (General Atomics Co., San Diego, CA (USA)). Oct 1988. Contract AC03-84ER51044;AC02-76CH03073;W-7405-ENG-48. 13p. (CONF-881015—23). NTIS, PC A03/MF A01. Order Number DE89001437/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

Electron cyclotron heating (ECH) experiments in the DIII-D tokamak have been performed at power levels around 1 MW using outside launch of both the extraordinary and ordinary mode, and inside launch of the extraordinary mode. Effective plasma heating has been obtained, with central electron temperatures up to 5 keV. In addition to simple bulk heating, the localized nature of ECH has been used to obtain the H-mode, to suppress internal disruptions (sawteeth), and to suppress MHD activity at the plasma edge. Suppression of Edge Localized Modes results in a clear improvement of the confinement properties of the H-mode, with the improvement manifested in both density and electron temperature. 16 refs., 2 figs.

58107 **(IAEA-CN—50/C-1-5-2) Low-aspect-ratio torsatrons.** Carreras, B.A.; Dominguez, N.; Garcia, L.; Lyon, J.F.; Painter, S.L.; Sheffield, J.; Lynch, V.E.; Cary, J.R.; Hanson, J.D. (Oak Ridge National Lab., TN (USA); Oak Ridge Y-12 Plant, TN (USA); Colorado Univ., Boulder (USA); Auburn Univ., AL (USA)). 1988. Contract AC05-84OR21400. 4p. (CONF-881015—11). NTIS, PC A02/MF A01. Order Number DE88016719/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

Stellarator with plasma aspect ratios in the range of 3.5 to 5 can be created using the Compact Torsatron configurations. Stable operation at high β should be possible in these devices if a vertical field coil system is designed to avoid breaking of the magnetic surfaces at finite {beta). The direct loss of energetic particles can be high, but the addition of an external quadrupole field can reduce these losses. Such a system looks attractive as a reactor. 9 refs; 1 fig.

58108 **(IAEA-CN—50/D-4-8) Advances in the theory of ion-temperature-gradient-driven turbulence.** Biglari, H.; Diamond, P.H.; Rosenbluth, M.N.; Waltz, R.E.; Dominguez, R.R.; Terry, P.W.; Mattor, N.; Lyster, P.; Leboeuf, J.N.; Carreras, B.A. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400;FG03-88ER53275;FG03-85ER53199;AC03-84ER53158. 14p. (CONF-881015—19). NTIS, PC A03/MF A01. Order Number DE89001189/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

The theory of ion-temperature-gradient-driven instabilities and turbulence has been extended to investigate the influence of higher radial eigenmodes, sheared toroidal rotation, flat density profiles, and low ion collisionality regimes. Predictions of the theory, which includes both analysis and numerical simulation, for present and future-generation tokamaks are discussed. 19 refs., 6 figs., 1 tab.

58109 **(IAEA-CN—50/E-2-5) Full-wave modeling of ion cyclotron heating in tokamaks.** Batchelor, D.B.; Jaeger, E.F.; Carreras, B.A.; Weitzner, H.; Imre, K.; Fuchs, V.; Bers, A. (Oak Ridge National Lab., TN (USA); International Atomic Energy Agency, Vienna (Austria)). 1988. Contract AC05-84OR21400;FG05-80ET53088;AC02-78ET51013. 8p. (CONF-881015—10). NTIS, PC A02/MF A01. Order Number DE88016815/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

Three major issues in the theoretical modeling of high-power ICRH experiments are the effects of wave fields on low-density surface plasma (especially their influence on impurity generation), the proper treatment of k/sub {parallel}/ variations and nonlocal effects caused by the finite poloidal magnetic field B/sub p/, and the development of efficient methods to compute reflection, absorption, transmission and mode conversion coefficients. To address the first of these issues, the 2D finite difference code ORION has been modified to solve the vector wave equation in Cartesian coordinates and to include the component of {rvec E} parallel to B. Our numerical results show that direct inversion of {del} {times} {del} {times} {rvec E} fails to correctly model the surface charge induced on the Faraday shield blades, thus causing an artificially large drop in loading when the shield is present. Introduction of the potentials {rvec A} and {Phi} resolves this problem and gives an approximately constant field in the Faraday shield gap as expected. 6 refs., 3 figs.

58110 (INIS-BR—1229, pp 78) **Electron cyclotron wave absorption by the fast tail generated by the DC electric field in Tokamak plasmas.** Giruzzi, G.; Krivenski, V.; Fidone, I.; Ziebell, L.F. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58111 (INIS-BR—1229, pp 80) **Angular and momentum distribution dependence of electron cyclotron absorption and amplification in mirror-confined plasmas.** Ziebell, L.F.; Granata, G. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58112 (INIS-BR—1229, pp 81) **Electron-cyclotron heating of a Tokamak reactor with the extraordinary mode.** Fidone, I.; Giruzzi, G.; Krivenski, V.; Zibell, L.F.; Mazzucato, E. (Association Euratom-CEA, Fontenay-aux-Roses (France); Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica; Princeton Univ., NJ (USA)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58113 (INIS-BR—1229, pp 82) **Cross effects on electron-cyclotron and lower-hybrid current drive in Tokamak plasmas.** Fidone, I.; Giruzzi, G.; Krivenski, V.; Mazzucato, E.; Ziebell, L.F. (Association Euratom-CEA, Fontenay-aux-Roses (France); Princeton Univ., NJ (USA)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58114 (INIS-BR—1229, pp 83) **Electron cyclotron wave damping for oblique propagation in hot plasmas.** Fidone, I.; Giruzzi, G.; Krivenski, V.; Ziebell, L.F. (Association Euratom-CEA, Fontenay-aux-Roses (France)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58115 (INIS-BR—1229, pp 78) **Dissipative instabilities at the edge of reversed field pinches driven by a combination of plasma gradients and a parallel current.** Mondt, J.P.; Goedert, J. (Los Alamos National Lab., NM (USA)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58116 (INIS-BR—1229, pp 81) **Electron cyclotron damping for large wave power in Tokamak plasmas.** Krivenski, V.; Fidone, I.; Giruzzi, G.; Meyer, R.L.; Ziebell, L.F. (Association Euratom-CEA, Fontenay-aux-Roses (France); Nancy-1 Univ., 54 (France)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58117 (INIS-BR—1229, pp 82) **Power dependence of electron cyclotron wave damping in Tokamak plasmas.** Krivenski, V.; Fidone, I.; Giruzzi, G.; Meyer, R.L.; Ziebell, L.F. (Association Euratom-CEA, Fontenay-aux-Roses (France); Nancy-1 Univ., 54 (France)). 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58118 (INIS-BR—1229, pp 83) **Temperature effect on ion acoustic solitons in plasmas with near critical density of negative ions.** Rizzato, F.B.; Schneider, R.S.; Dillenburg, D. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58119 (INIS-BR—1229, pp 85) **Quasilinear equation for oscillations in magneto plasmas in a weakly relativistic approximations.** Rizzato, F.B. 1987. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704021/JAW.

In Progress Report 1985-1986.

58120 (INIS-mf—11310, pp 43) **FUPO - a computer code to calculate the fusion power density.** Kernbichler, W. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

58121 (INIS-mf—11310, pp 42) **FUREPO - a computer code to calculate the power balance in a fusion reactor.** Kernbichler, W. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

58122 (INIS-mf—11310, pp 11) **Energy balance in magnetically confined fusion plasmas.** Kernbichler, W. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

58123 (INIS-mf—11310, pp 46) **SUMINT - a computer code to calculate the so-called exact representation of the absorption coefficient for the synchrotron radiation.** Nassri, A.; Malli, K. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

58124 (INIS-mf—11310, pp 41) **ENBAL - a computer code for solving energy balance equations in fusion plasmas.** Kernbichler, W. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

58125 (INIS-mf—11310, pp 40) **PARBAL - a computer code for solving particle balance equations in a fusion plasma.** Kernbichler, W. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

58126 (INIS-mf—11310, pp 25) **Mean temporal energy change of ions in a plasma due to their Coulomb interaction in quasi-equilibrium.** Langmann, E. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

58127 (INIS-mf—11310, pp 24) **Nuclear Elastic Scattering (NES).** Kernbichler, W.; Heinrichs, G. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

58128 (INIS-mf—11310, pp 23) **Accuracy of the new analytical representations of absorption-and emission coefficients.** Nassri, A. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

58129 (INIS-mf—11310, pp 22) **Analytical treatment of absorption- and emission coefficients for synchrotron radiation in plasmas.** Nassri, A. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

58130 (INIS-mf—11310, pp 21) **Synchrotron radiation losses from plasmas: an overview.** Nassri, A. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

58131 (INIS-mf—11310, pp 12) **Particle balance and fusion cycles.** Kernbichler, W. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

58132 (INIS-SU—42, pp 26-28) **Study on parameters of soft x radiation from plasma focus device.** Belkov, M.G.; Belyaev, P.A.; Zajtsev, V.M. and others. (OKB Gorizont, Moscow). 1987. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89780009/JAW.

Kratkie Soobshcheniya po Fizike.; (no.8).
In Experimental and theoretical physics. Collection.

Results of investigating soft X-radiation (SXR) from four plasma focus devices with the batteries energy content from 20 to 250 kJ are presented. SXR total yield dependence on the battery energy content and concentration of deuterium impurities is obtained. Plasma electron temperature distribution in Pinch axis is presented. 6 refs.; 1 fig.

58133 (INIS-SU—42, pp 36-38) **Longitudinal wave excitation by diffusing packet of electromagnetic radiation.** Kirsanov, V.I. (AN SSSR, Moscow. Inst. Obshchej Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89780009/JAW.

Kratkie Soobshcheniya po Fizike.; (no.8).
In Experimental and theoretical physics. Collection.

Effect of dispersive diffusion of a longitudinal electromagnetic radiation packet on plasma wave excitation is considered. It is shown that diffusion of sufficiently short packets continue excitation of plasma wave with practically unchanged amplitude. 6 refs.

58134 (INIS-SU—44/A, pp 52-54) **Green function for a radiation cascade.** Syrkin, M.I. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780010/JAW.

Kratkie Soobshcheniya po Fizike.; (no.10).
In Experimental and theoretical physics. Collection.

The Green function for two-dimensional radiation cascade between the Rydberg levels in rarefied plasma is being studied. Perturbation theory by transits number in cascade is developed and approximational formula for the Green function is estimated. 7 refs.; 1 fig.

58135 (INIS-SU—44/A, pp 24-25) **Nondissipative electrosound waves in an inhomogeneous and nonstationary plasma.** Krokhin, O.N.; Tsybenko, S.P. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780010/JAW.

Kratkie Soobshcheniya po Fizike.; (no.10).
In Experimental and theoretical physics. Collection.

The problem of nondissipative electrosound S-polarized waves is solved for inhomogeneous and nonstationary plasma in linear transparency range. Spatial averaging of plasma and electromagnetic field equations is made. Closed-type equation system is obtained for mean values, which automodel asymtotics gives field amplitude monotone reduction with plasma density growth. 6 refs.

58136 (INIS-SU—44/A, pp 55-57) **On the angular distribution of pulsations of ion-sound turbulence in a plasma.** Silin, V.P. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780010/JAW.

Kratkie Soobshcheniya po Fizike.; (no.10).
In Experimental and theoretical physics. Collection.

Angular distribution of pulsations of ion-sound turbulence in a plasma is being studied. Regularization of Rudakov-Korablev peculiarity in angular disribution is determined under the conditions

of small Knudsen turbulent value and absence of resonance ions regularizating contribution. 8 refs.

58137 (INIS-SU—45, pp 32-34) **Study on the neutron radiation spatial anisotropy at plasma focus devices.** Volobuev, I.V.; Gribkov, V.A.; Krokhin, O.N.; Denus, S.; Sledzinskij, S.; Chekaj, S. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780096/JAW.

Kratkie Soobshcheniya po Fizike.; (no.11).

In Plasma physics. Collection.

The dependence of spatial anisotropy of neutron radiation at plasma focus (PF) devices is studied. It is found that in case of chamber filling by deuterium with argon addition the anisotropy character coincides with the one conventionally observed at PF devices, whereas in case of pure deuterium use the anisotropy character changes for the opposite one. 7 refs.; 3 figs.

58138 (INIS-SU—45, pp 41-42) **Electromagnetic sygnal transfer throught a dense plasma.** Ramazashvili, R.R. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780096/JAW.

Kratkie Soobshcheniya po Fizike.; (no.11).

In Plasma physics. Collection.

The possibility of electromagnetic signal transfer through a dense slightly heterogeneous layer of nonisothermal hot electron plasma is discussed. The transfer is based on the mixing of two waves, the frequencies of which differ by an order of a long-wave ionic sound frequency. 5 refs.

58139 (INIS-SU—48, pp 7-13) **Magnetic configuration of the Uragan-3 torsatron with a divertor.** Besedin, N.T.; Bykov, V.E.; Georgievskij, A.V. and others. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780011/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; (no.4).

In Thermonuclear synthesis. Scientific-technical collection.

Results of investigations into magnetic configuration of the Uragan-3 torsatron intermittently performed from 1981 through 1986 are given. The comparison of numeric investigations and measurements at a device gave a rather complete and clear idea of configuration of vacuum magnetic field. It is found that the average radius of confinement region with inserted magnetic surfaces is 8.5+-0.5 cm and somewhat changes with the alteration of vertical magnetic field. Inserted magnetic surfaces are surrounded by an ergodic magnetic field with the average width of 3.5+-0.5 cm where magnetic force lines trace 1-10 times around torus. The structure of diverted magnetic field is close to calculated value. The difference of ideal and actual configuration observed is evidently the consequence of nonprecise preparation of device magnetic system. 10 refs.; 10 figs.

58140 (INIS-SU—48, pp 3-6) **Neoclassical coefficients of plasma transport in present stellarators.** Bykov, V.E.; Volkov, E.D.; Georgievskij, A.V.; Peletminskaya, A.V.; Shishkin, A.A. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780011/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; (no.4).

In Thermonuclear synthesis. Scientific-technical collection.

For stellarator-type traps "Helitron-E", ATF-1 and "Uragan-2M" the harmonic content of magnetic field is analysed and the geometric factors of neoclassical transport coefficient in the interval of intermediate collision frequencies (plateu regime) and small collision frequencies ($1/\nu$ regime are obtained. 12 refs.; 2 figs.; 1 tab.

58141 **(IPP—5/19) Neoclassical impurity transport in the presence of toroidal and poloidal rotation.** Feneberg, W. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Jun 1988. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755173/JAW.

This paper presents an extended theory of neoclassical impurity transport, starting from the parameters of bulk plasma toroidal and poloidal rotation. Analytic expressions resulting from the influence of a compressible flow on the perpendicular momentum balance and on the neoclassical Braginskii parallel viscosity are derived. The predicted impurity transport is extensively compared with that in earlier papers.

58142 **(IPP—5/20) Overview of the theory of lower hybrid and ion cyclotron heating of tokamak plasmas.** Bambilla, M. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Jun 1988. 67p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755174/JAW.

Some effort is devoted to discuss the linear dispersion relation and the mechanisms of wave-particle interactions. In particular it is tried to show how the guidelines for heating experiments are dictated by the properties of linear plasma waves. LH waves have very attractive features as far as generation and coupling is concerned, and have proved to be the best candidate for h.f. current drive. ICRH has proved very successful, and there is every reason so believe that it will remain so in reatorgrade plasmas. The status of ICRH theory can be considered satisfactory: the basic mechanisms of coupling, propagation and absorption are well understood, and modeling has recently improved to the point of including also fine effects such as the influence of toroidicity on mode conversion.

58143 **(IPP—5/21) Stabilisation of the m=2 tearing mode with applied helical fields.** Hender, T.C.; Riedel, K.S.; Grassie, K. (UKAEA Culham Lab., Abingdon; New York Univ., NY (USA)). (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.); UKAEA Culham Lab., Abingdon; New York Univ., NY (USA)). Jun 1988. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755289/JAW.

The necessary response times for feedback stabilisation of the m=2 tearing mode with externally applied m=2 helical fields are examined. Since the timescales for full penetration of the applied field are much longer than the relevant times for the feedback, the cancellation of the m=2 island by the applied field is necessarily transient. Continued penetration of the applied field leads to an island whose phase is 'flipped' relative to the initial plasma island. This flip mechanism places constraints on the helical coil current. If the feedback helical field is not exactly anti-phased relative to the plasma island, then a net torque results which also tends to flip the plasma island. This torque mechanism places constraints on the tolerable phase error and response times of the feedback helical field. For parameters consistent with JET and a phase error of 10/sup 0/, the necessary response time is < or approx. 500 μs.

58144 **(IPP—6/274) Hysteresis in the nonlinear driven drift and KdV equations.** He Kaifen; Salat, A. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Apr 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755175/JAW.

A nonlinear driven/damped differential equation is numerically studied in a parameter region where the energy tends to a constant, E/sub s/, for t -> ∞. It is found that E/sub s/ (ϵ) traces a hysteresis curve when the driving amplitude ϵ is cyclically varied.

58145 **(IPP—6/275) Hysteresis and onset of chaos in periodically driven nonlinear drift waves.** He Kaifen; Salat, A. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Apr 1988. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755176/JAW.

A driven/damped nonlinear drift equation is solved numerically. In (amplitude, frequency Ω) space the properties of the solutions repeat in a selfsimilar way in cells of decreasing size for Ω -> 0. Within each cell there are regions of constant, periodic, doubly periodic, etc. or chaotic energy E(t) for t -> ∞. Regions of Ω with a 'high' and a 'low' branch solution of E also exist simultaneously, which gives rise to hysteresis for cyclically varied amplitude. Hopf bifurcations may take place on both branches. The width of the hystereses depends on the initial conditions. The space dependence of phi and its spectral properties are also studied.

58146 **(IPP—III/135) Observation of precursor magnetic oscillations to the H-mode transition of ASDEX.** Toi, K.; Gernhardt, J.; Klueber, O.; Kornherr, M. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). May 1988. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755177/JAW.

Precursor oscillations to the H-mode transition are identified in magnetic fluctuations of the ASDEX H-mode discharges initiat-

ed without a sawtooth. This precursor is m=4/n=1 mode, rotating with f ≈ 10 kHz in the opposite direction to co-injected neutral beams. Time behaviour of the amplitude suggests that the H-mode transition is caused, not by the edge electron temperature, but by the edge current density.

58147 **(ITEF—6(1988)) Cutting the excite levels of plasma ions.** Gerusov, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1988. 17p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704360/JAW.

Principal quantum number of last level of plasma ion is calculated in dependence of temperature T and concentration of electrons N/sub e/ in the range 10/sup 4/≦T≦10/sup 8/ k, 10/sup 13/ < N/sub e/ < 10/sup 25/ cm/sup -3/. All higher levels of isolated ion vanishe due to interaction with neighbouring particles. Any mechanism of cutting the excite levels is compared. These mechanisms are cutting because of neighbour particles, because of Debye interaction, because of plasma electric microfields, because of finite lifetime (this mechanism is proposed at first). Also the calculation of last level of observed spectral line is carried out. In its determination the linear Stark-effect plays main role. 11 refs.; 2 figs.

58148 **(LA-UR—88-2708) The tilt mode, turbulence and transport in field-reversed configurations.** Lewis, H.R.; Barnes, D.C.; Bishop, R.C.; Krall, N.A.; Mikic, Z.; Milroy, R.D.; Mirin, A.A.; Sgro, A.G.; Shumaker, D.E.; Staudenmeier, J.L. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 10p. (CONF-881015—6; IAEA-CN—50/C-5-15). NTIS, PC A02/MF A01. Order Number DE88016220/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

An outstanding theoretical problem of great importance in research on field-reversed configurations (FRCs) is the explanation of the observed stability of FRCs to the internal tilt mode. For example, in the Los Alamos FRX-C experiment, FRCs showed no evidence of the internal tilt mode during experimental lifetimes of up to 300 μs, which is over an order of magnitude longer than the expected ideal MHD growth time. Finite-Larmor-radius (FLR) theory is inappropriate for the FRC configuration and the observed stability has not been explained by FLR theory. We are engaged in MHD and kinetic studies of the tilt mode that are aimed at explaining the observed stability in FRC experiments. These studies are within the contexts of two physical models: resistive MHD and the Vlasov-fluid model (collisionless ions, massless fluid electrons). Computer codes that implement both linearized and fully nonlinear versions of these models are being used. Our results do not yet provide an adequate explanation of the observed stability, although a strongly stabilizing tendency due to kinetic ion effects has been observed. The effects of plasma rotation appear to be unimportant. It seems most likely that a combination of profile effects, ion kinetic effects and nonlinear effects will be required to understand the gross stability of FRCs. The theoretical and simulational evidence for interior turbulence in FRCs is overwhelming. For investigating the important subject of turbulence and transport in FRCs, we use both analytic studies and numerical simulation. A conclusion of our investigations is that FRC transport laws should not be based on lower-hybrid-drift (LHD) modes localized near the separatrix, but should be based on low-frequency turbulence occurring throughout the FRC profile. 18 refs., 1 fig.

58149 **(LA-UR—88-2821) Status of the field-reversed configuration as an alternate confinement concept.** Tuszewski, M. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 18p. (CONF-881031—3). NTIS, PC A03/MF A01. Order Number DE88016150/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

The status and main issues of field-reversed configuration research are briefly reviewed. The unusual fusion reactor potential of these plasmas is also described, in particular for systems that would burn D-^{3}He fuels. The field-reversed configuration is ideal for possible use of advanced fuels because its simple geometry includes a natural divertor that should allow efficient direct conversion. 27 refs., 4 figs.

58150 **(LA-UR—88-2878) Field-reversed configuration (FRC) experiments.** Siemon, R.E.; Chrien, R.E.; Hugrass, W.N.; Okada, S.; Rej, D.J.; Taggart, D.P.; Tuszewski, M.; Webster, R.B.; Wright, B.L.; Slough, J.T.; Crawford, E.A.; Hoffman, A.L.; Milroy, R.D.; Vlases, G.C.; Brooks, R.D.; Kronast, B.; Pietrzyk, Z.A.; Raman, R.; Smith, R. (Los Alamos National Lab., NM (USA); Spectra Technology, Inc., Bellevue, WA (USA); Seattle Univ., WA (USA)). 1988. Contract W-7405-ENG-36. 15p. (IAEA-CN—50/C-4-1; CONF-881015—16). NTIS, PC A03/MF A01. Order Number DE89000389/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

FRCs with equilibrium separatrix radii up to 0.18 m have been formed and studied in FRX-C/LSM. For best formation conditions at low fill pressure, the particle confinement exceeds the predictions of LHD transport calculations by up to a factor of two; however, the inferred flux confinement is more anomalous than in smaller FRCs. Higher bias field produces axial shocks and degradation in confinement, while higher fill pressure results in gross fluting during formation. FRCs have been formed in TRX with s from 2 to 6. These relatively collisional FRCs exhibit flux lifetimes of 10 → 20 kinetic growth times for the internal tilt mode. The coaxial slow source has produced annular FRCs in a coaxial coil geometry on slow time scales using low voltages. 16 refs., 4 figs., 1 tab.

58151 **(LA-UR—88-2888) Technology and physics implications of oscillating-field current drive in reversed-field pinches.** Bathke, C.G.; Krakowski, R.A.; Schoenberg, K.F. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 7p. (CONF-881031—9). NTIS, PC A02/MF A01. Order Number DE89000388/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

The property of reversed-field pinches (RFPs) to relax to a near- minimum-energy state is the basis of oscillating-field current drive (OFCD), wherein plasma current is driven by modulating in quadrature the external toroidal and poloidal magnetic fields. Coupled plasma/circuit OFCD simulations of RFPs ranging from present experiments (ZT-P and ZT-40M) to the reactor (TITAN) indicate that the drive frequency and the amplitude of the plasma-current oscillations decrease with decreased plasma resistance so that minimum frequencies ({approximately}25 Hz) and plasma-current amplitudes ({approximately}1.6%) and maximum efficiencies ({approximately}0.3 A/W) are attained in the reactor regime. Methods for minimizing the reactive powers and for optimizing the current-drive efficiency for OFCD in RFPs have been identified. 15 refs., 4 figs., 1 tab.

58152 **(LA-UR—88-2912) The high density Z-pinch.** McCall, G.H. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 15p. (CONF-8807111—1). NTIS, PC A03/MF A01. Order Number DE89000382/JAW.

From 3. Latin-American workshop on plasma physics; Santiago, Chile (18 Jul 1988).

During the past few years techniques have been developed for producing pinches in solid deuterium. The conditions which exist in these plasmas are quiet different from those produced earlier. The pinch is formed from a fiber of solid deuterium rather than from a low density gas, and the current is driven by a low impedance, high voltage pulse generator. Because of the high initial density, it is not necessary to compress the pinch to reach thermonuclear conditions, and the confinement time required for energy production is much shorter than for a gas. The experimental results, which have been verified by experiments performed at higher current were quite surprising and encouraging. The pinch appeared to be stable for a time much longer than the Alfven radial transit time. In this paper, however, I argue that the pinch is not strictly stable, but it does not appear to disassemble in a catastrophic fashion. It appears that there may be a distinction between stability and confinement in the high density pinch. In the discussion below I will present the status of the high density Z-pinch experiments at laboratories around the world, and I will describe some of the calculational and experimental results. I will confine my remarks to recent work on the high density pinch. 17 refs. 10 figs.

58153 (PPPL—2468-R) Feedback stabilization of the axisymmetric instability of a deformable tokamak plasma. Pomphrey, N.; Jardin, S.C.; Ward, D.J. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Oct 1988. Contract AC02-76CH03073. 26p. (In EN). NTIS, PC A03/MF A01. Order Number DE89001172/JAW.

We analyze the magnetohydrodynamic (MHD) stability of the axisymmetric system consisting of a free boundary, noncircular cross-sectional tokamak plasma, finite resistivity passive conductors, and an active feedback system with magnetic flux pickup loops, a proportional amplifier with gain G, and current-carrying poloidal field coils. Numerical simulation of the system when G is set to zero identifies flux loop locations which correctly sense the plasma motion. However, when certain of these locations are incorporated into an active feedback scheme, the plasma fails to be stabilized no matter what value of the gain is chosen. Analysis, by means of an extended energy principle, indicates that this failure is due to the deformability of the plasma cross section. 7 figs.

58154 (PPPL—2552) Nonlinear gyrokinetic Maxwell-Vlasov equations using magnetic coordinates. Brizard, A. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Sep 1988. Contract AC02-76CH03073. 26p. NTIS, PC A03/MF A01. Order Number DE89001174/JAW.

A gyrokinetic formalism using magnetic coordinates is used to derive self-consistent, nonlinear Maxwell-Vlasov equations that are suitable for particle simulation studies of finite-β tokamak microturbulence and its associated anomalous transport. The use of magnetic coordinates is an important feature of this work as it introduces the toroidal geometry naturally into our gyrokinetic formalism. The gyrokinetic formalism itself is based on the use of the Action-variational Lie perturbation method of Cary and Littlejohn, and preserves the Hamiltonian structure of the original Maxwell-Vlasov system. Previous nonlinear gyrokinetic sets of equations suitable for particle simulation analysis have considered either electrostatic and shear-Alfven perturbations in slab geometry, or electrostatic perturbations in toroidal geometry. In this present work, fully electromagnetic perturbations in toroidal geometry are considered. 26 refs.

58155 (PPPL—2553) Magnetostatic equilibria bounded by a nonanalytic x-point. Reusch, M.F. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Sep 1988. Contract AC02-76CH03073. 12p. NTIS, PC A03/MF A01. Order Number DE89001175/JAW.

A solution of a magnetostatic equilibrium problem solving an x-point of a form given by Harold Grad is applied to the case where the x-point and null lines emanating from it form the boundary of the plasma, separating it from a current-free vacuum region. Several conventional notions are violated. The solution has no Taylor expansion at the x-point. The inter-separatrix angle may not be 90 degrees and can range from 0 to 180 degrees. The current data does not vanish in the vicinity of the x-point. 5 refs., 4 figs.

58156 (PPPL—2554) The effect of ion drifts on the properties of the tokamak scrape-off plasma. Petravic, M.; Kuo-Petravic, G. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Sep 1988. Contract AC02-76CH03073. 15p. NTIS, PC A03/MF A01. Order Number DE89001176/JAW.

A plasma fluid model which takes into account ion drifts has been constructed and applied to the scrape-off layer of a tokamak with a poloidal divertor. This model predicts near-sonic toroidal velocities and large poloidal flows in most of the scrapeoff together with steep gradients in the pressure and electrostatic potential along the magnetic field near the X-point, contrary to the predictions of the standard model. The potential step at X-point should reduce parallel heat transport and could act as an H-mode trigger. 12 refs., 4 figs.

58157 (PPPL—2557) Local full-wave energy in nonuniform plasmas. Smithe, D.N. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Oct 1988. Contract AC02-76CH03073. 26p. NTIS, PC A03/MF A01. Order Number DE89001177/JAW.

The subject of local wave energy in plasmas is treated via quasilinear theory from the dual perspectives of the action-angle formalism and gyrokinetics analysis. This work presents an extension to all orders in the gyroradius of the self-consistent wave-propagation/quasilinear-absorption problem using gyrokinetics. Questions of when and under what conditions local energy should be of definite sign are best answered using the action-angle formalism. An important result is that the "dielectric operators" of the linearized wave equation and of the local energy are not the same, a fact which is obscured when the eikonal or WKB assumption is invoked. Even though the two dielectrics are very different in character (one operates linearly on electric field for the plasma current, the other operates quadratically for the energy), it is demonstrated that they are nevertheless related by a simple mathematical statement. This study was originally motivated by concern and lively discussion over the questions of local energy for rf-heating of plasmas, where in certain instances, full-wave effects such as refraction, strong absorption, and mode conversion are of primary importance. Fundamentally, the rf-absorption must equate with the energy moment of the quasilinear term to achieve a correct energy balance. This fact governs the derivation (as opposed to postulation) of the local absorption. The troublesome "kinetic flux" may then be chosen (it is not unique) to satisfy a wave-energy balance relation with the Poynting flux and local absorption. It is shown that at least one such choice reduces asymptotically to the Stix form away from nonuniformities, thereby demonstrating energy conservation to all orders in Larmor radius. 25 refs.

58158 (SAND—87-2973C) Release of deuterium from carbon during low-energy helium and carbon ion bombardment. Wampler, W.R.; Doyle, B.L. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 2p. (CONF-880512—13). NTIS, PC A03/MF A01. Order Number DE89000504/JAW.

From 8. international conference on plasma surface interactions in controlled fusion devices; Julich, F.R. Germany (2 May 1988).

Ion-induced release of deuterium (D) from carbon was investigated as a possible mechanism for the supershot conditioning in TFTR. Carbon was implanted to saturation with 300 eV D and then bombarded with 0.6 and 1.2 keV helium ions and 3 keV carbon ions. Nuclear reaction analysis was used to monitor the areal density of D remaining in the samples during the ion bombardment. Initial D releases rates up to 10 D atoms per incident ion were observed. The results show that the amount of D that would be removed by ion-induced release from the TFTR limiter is similar to the pumping capacity produced by supershot conditioning. 9 refs., 5 figs.

58159 (SAND—88-1257C) Measurements of energy and flux of neutrals at the wall in TFTR. Wampler, W.R.; Kilpatrick, S.J. (Sandia National Labs., Albuquerque, NM (USA); Princeton Univ., NJ (USA). Plasma Physics Lab.). 1988. Contract W-7405-ENG-36. 16p. (CONF-881002—12). NTIS, PC A03/MF A01. Order Number DE89001166/JAW.

From 35. national vacuum symposium and 4th international laser science conference; Atlanta, GA, USA (2 Oct 1988).

The energy and flux of charge-exchange neutral deuterium incident on the wall in TFTR were measured using a carbon resistance probe. This device utilizes the increase in electrical resistance of a thin carbon film produced by the impinging particles. Particle energies and fluxes were determined from the stopping effect of thin layers of silicon over the carbon. Film thicknesses were chosen to give a useful energy range from about 50 to 5000 eV. Time-resolved data were obtained for the first time by using a transient digitizer to record the signals every millisecond during the discharge. The deduced flux and Maxwellian temperature were 0.7 {times} 10^{14}/cm^{2}s and kT = 350 eV, respectively during ohmic heating. Neutral beam heating (10 MW) increased both the temperature and flux by about a factor of two. The observed flux of neutrals to the wall is large enough for changes in the recycling of these particles to affect plasma fueling significantly. 10 refs., 2 figs., 1 tab.

58160 (SAND—88-2414C) Trapping and ionization by plasma electrons in IFR beam propagation in the presence of an axial field. Shokair, I.R. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 9p. (CONF-8809149—2). NTIS, PC A02/MF A01. Order Number DE89000454/JAW.

From DARPA/SDIO services annual propagation review; Newport, RI, USA (12 Sep 1988).

As a relativistic electron beam propagates into a plasma channel in the ion-focused regime (IFR), the plasma electrons are ejected under the influence of the beam electrostatic field. If there is an axial magnetic field, it is possible for the plasma electrons to be trapped on orbits within the drift tube radius. These trapped electrons are highly energetic (compared to ionization energies) and thus for long pulse beams it is possible that the channel density would vary as a function of time due to ionization by the trapped electrons. It is also possible that plasma electrons trapped in the vicinity of the beam would cause electron-electron instabilities. Trapping and ionization by plasma electrons is considered in this paper. First, we derive a transcendental equation for the electron trapping radius in terms of the beam parameters and the external field. We then find an expression for the time-averaged plasma electron density profile in the presence of the relativistic beam. Finally, we estimate the ionization rate by these electrons. In the following analysis, it is assumed that only the beam electrostatic forces act on the plasma electrons; that is, forces due to channel ions and electrons are neglected. This limits the applicability of the analysis to problems with small neutralization fractions. We also neglect electrodynamic effects. 1 ref., 2 figs.

58161 (UCRL—53881) Hot-electron plasma formation and confinement in the tandem mirror experiment-upgrade. Ress, D.B. (Lawrence Livermore National Lab., CA (USA)). Jun 1988. Contract W-7405-ENG-48. 169p. NTIS, PC A08/MF A01. Order Number DE89000664/JAW.

The tandem mirror experiment-upgrade (TMX-U) at the Lawrence Livermore National Laboratory (LLNL) is the first experiment to investigate the thermal-barrier tandem-mirror concept. One attractive feature of the tandem magnetic mirror as a commercial power reactor is that the fusion reactions occur in an easily accessible center-cell. On the other hand, complicated end-cells are necessary to provide magnetohydrodynamic (MHD) stability and improved particle confinement of the center-cell plasma. In these end-cells, enhanced confinement is achieved with a particular axial potential profile that is formed with electron-cyclotron range-of-frequency heating (ECRF heating, ECRH). By modifying the loss rates of electrons at spatially distinct locations within the end-cells, the ECRH can tailor the plasma potential profile in the desired fashion. Specifically, the thermal-barrier concept requires generation of a population of energetic electrons near the midplane of each end-cell. To be effective, the transverse (to the magnetic field) spatial structure of the hot-electron plasma must be fairly uniform. In this dissertation we characterize the spatial structure of the ECRH-generated plasma, and determine how the structure builds up in time. Furthermore, the plasma should efficiently absorb the ECRF power, and a large fraction of the electrons must be well confined near the end-cell midplane. Therefore, we also examine in detail the ECRH power balance, determining how the ECRF power is absorbed by the plasma, and the processes through which that power is confined and lost. 43 refs., 69 figs., 6 tabs.

58162 (UCRL—98503) Microwave heating and current drive in tokamaks. Cohen, B.I.; Cohen, R.H.; Kerbel, G.D.; Logan, B.G.; Matsuda, Y.; McCoy, M.G.; Nevins, W.M.; Rognlien, T.D.; Smith, G.R.; Harvey, R.W.; Kritz, A.H.; Bonoli, P.T.; Porkolab, M. (Lawrence Livermore National Lab., CA (USA); General Atomics Co., San Diego, CA (USA); Hunter Coll., New York (USA); Massachusetts Inst. of Tech., Cambridge (USA)). 23 Aug 1988. Contract W-7405-ENG-48;AC02-78ET51013;AC03-84ER53158;FG02-84ER53187. 12p. (IAEA-CN—50/G-4-10; CONF-881015—17). NTIS, PC A03/MF A01. Order Number DE88017019/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

The use of powerful microwave sources provide unique opportunities for novel and efficient heating and current-drive schemes in the electron-cyclotron and lower-hybrid ranges of frequencies. Free- electron lasers and relativistic klystrons are new sources that have a number of technical advantages over conventional, lower-intensity sources; their use can lead to improved current-drive efficiencies and better penetration into a reactor-grade plasma in specific cases. This paper reports on modeling of absorption and current drive, in intense-pulse and quasilinear regimes, and on analysis of parametric instabilities and self-focusing. 16 refs., 2 figs.

58163 (UCRL—98670) A non-inductively driven steady state tokamak reactor. Fenstermacher, M.E.; Devoto, R.S.; Bulmer, R.H.; Lee, J.D.; Miller, J.R.; Schultz, J. (Lawrence Livermore National Lab., CA (USA)). 20 Sep 1988. Contract W-7405-ENG-48. 7p. (CONF-881031—20). NTIS, PC A02/MF A01. Order Number DE89001243/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

The physics and engineering guidelines for the ITER device are shown to lead to viable and attractive operating points for a steady state tokamak power reactor. Non-inductive current drive is provided in steady state by high energy neutral beam injection in the plasma core, lower hybrid slow waves in the outer regions of the plasma and bootstrap current. Plasma gain Q ({equivalent←to}fusion power/input power) in excess of 20 and average neutron wall loading, $\langle \Gamma \rangle \sim 2.0$ MW/m^2 are predicted in a device with major radius, $R_o = 7.5$ m and minor radius, $a = 2.8$ m. 15 refs., 3 figs., 3 tabs.

58164 Pulsed-ultraviolet laser Raman diagnostics of plasma processing discharges. Hargis P.J. Jr.; Greenberg, K.E. (Sandia National Laboratories, Albuquerque, New Mexico 87185-5800). *Applied Physics Letters;* **53**: No. 19, 1809-1811(7 Nov 1988).

Spontaneous Raman spectroscopy with pulsed-ultraviolet laser excitation of the Stokes vibrational Raman lines was used to measure the percent dissociation of nitrogen and sulfur hexafluoride in low-pressure radio refrequency discharges of the type used for processing semiconductor materials. Measurements of the percent dissociation of sulfur hexafluoride, at pressures between 200 and 600 mTorr, show a strong pressure dependence which is consistent with recombination playing an important role in sulfur hexafluoride discharge kinetics.

58165 Neutral beam injection and plasma convection in a magnetic field. Okuda, H.; Hiroe, S. (Plasma Physics Laboratory, Princeton University, P.O. Box 451, Princeton, New Jersey 08543). *Physics of Fluids;* **31**: No. 11, 3312-3321(Nov 1988).

Injection of a neutral beam into a plasma in a magnetic field has been studied by means of numerical plasma simulations. It is found that, in the absence of a rotational transform, the convection electric field arising from the polarization charges at the edges of the beam is dissipated by turbulent plasma convection, leading to anomalous plasma diffusion across the magnetic field. The convection electric field increases with the beam density and beam energy. In the presence of a rotational transform, polarization charges can be neutralized by the electron motion along the magnetic field. Even in the presence of a rotational transform, a steady-state convection electric field and hence anomalous plasma diffusion can develop when a neutral beam is constantly injected into a plasma. Theoretical investigations of the convection electric field are described for a plasma in the presence of a rotational transform.

58166 Reversed-field pinch Ohmic equilibria during current decay and termination. Caramana, E.J.; Nebel, R.A. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids;* **31**: No. 11, 3322-3329(Nov 1988).

The possible current decay and termination of reversed-field pinch discharges via stable, Ohmic, self-similar states that do not require any instabilities or dynamo effect for their maintenance are investigated. The equations that describe such states are derived; numerical solutions that are functions of the form of the resistivity

profile, the current decay rate, and the pinch parameter are presented. Relevant constraints on stable termination are discussed.

58167 **Oscillating field current drive in spheromaks.** Boozer, A.H. (Department of Physics, College of William and Mary, Williamsburg, Virginia 23185). *Physics of Fluids;* **31**: No. 11, 3338-3340(Nov 1988).

If a spheromak plasma with a flux hole relaxes sufficiently rapidly to the flat current profile of a Taylor state, then the plasma current can be maintained, or increased, by varying certain geometric ratios of the plasma. The theory of this type of current drive is developed in terms of the internal and external inductances of a spheromak.

58168 **Bromine dot target plasma spectroscopy: A detailed analysis.** Cerjan, C. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physics of Fluids;* **31**: No. 11, 3346-3352(Nov 1988).

A detailed simulation of the spectra produced from a bromine dot target by laser irradiation is presented. This study incorporates the results of a two-dimensional hydrodynamic calculation and an extensive atomic rate data base to generate synthetic spectra under conditions that match those of an earlier experiment. A dynamic picture of the plasma's evolution is given that is consistent with experimental results. Overall plasma characteristics are calculated that produce spectra largely in agreement with those observed. Also, sensitive dielectronic recombination features are reproduced corroborating the adequacy of this approach.

58169 **Modeling of reversed-field-pinch magnetic probe measurements.** Miller, G. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids;* **31**: No. 11, 3330-3337(Nov 1988).

Magnetic probe measurements carried out on the ZT-40M reversed field pinch [Fusion Technol. 8, 1571 (1985)] for low current (50 kA) discharges with and without F-Θ pumping are described. The internal probe measurements are used to determine the evolution of the axisymmetric equilibrium profiles. Of particular interest is the profile response to the large-amplitude, oscillatory, toroidal, and poloidal driving voltages applied during F-Θ pumping. The results are compared with a two-field-line stochastic magnetic field model.

58170 **Generalized parallel heat transport equations in collisional to weakly collisional plasmas.** Zawaideh, E.; Kim, N.S.; Najmabadi, F. (Hughes Aircraft Company, 6155 El Camino Real, Carlsbad, California 92008). *Physics of Fluids;* **31**: No. 11, 3280-3285(Nov 1988).

A new set of two-fluid heat transport equations that is valid from collisional to weakly collisional limits is derived. Starting from gyrokinetic equations in flux coordinates, a set of moment equations describing plasma energy transport along the field lines of a space- and time-dependent magnetic field is derived. No restrictions on the anisotropy of the ion distribution function or collisionality are imposed. In the highly collisional limit, these equations reduce to the classical heat conduction equation (e.g., Spitzer and Haerm or Braginskii), while in the weakly collisional limit, they describe a saturated heat flux (flux limited). Numerical examples comparing these equations with conventional heat transport equations show that in the limit where the ratio of the mean free path λ to the scale length of the temperature gradient L/sub T/ approaches zero, there is no significant difference between the solutions of the new and conventional heat transport equations. As λ/L/sub T/→1, the conventional heat conduction equation contains a significantly larger error than (λ/L/sub T/)^2. The error is found to be O(λ/L)^2, where L is the smallest of the scale lengths of the gradient in the magnetic field, or the macroscopic plasma parameters (e.g., velocity scale length, temperature scale length, and density scale length). The accuracy of the flux-limited model depends significantly on the value of the flux limit parameter which, in general, is not known. The new set of equations shows that the flux-limited parameter is a function of the magnetic field and plasma parameter profiles.

58171 **Electromagnetic trapped-particle sideband instability.** Cohen, B.I.; Cohen, R.H. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Physics of Fluids;* **31**: No. 11, 3444-3446(Nov 1988).

The sideband instability of a large-amplitude electromagnetic wave that traps electrons near the cyclotron resonance in a magnetized plasma is analyzed. The wave-trapped particles produce a weak instability. The growth rate and the criterion for the instability to exceed the threshold determined by collisional damping of the sidebands are given. This instability will have little consequence for the parameters expected in the microwave tokamak experiment at Lawrence Livermore National Laboratory [Proceedings of the 14th Annual Conference on Plasma Physics, St. Andrews, Scotland, 1987 (Pergamon, London, 1988), Paper No. 25].

58172 **Parametric decay of a fast wave to two electromagnetic slow waves at half the pump frequency.** Chiu, S.C. (General Atomics, San Diego, California 92138-5608). *Physics of Fluids;* **31**: No. 11, 3295-3298(Nov 1988).

The parametric decay process of a fast wave at the ion-cyclotron range of frequencies (ICRF) into two electromagnetic slow (or ordinary) waves is considered. It is shown that in the dipole approximation of the pump wave, the decay process is possible at around half the frequency of the pump. Plasmas of interest that are susceptible to this decay process include deuterium—hydrogen (D—H), deuterium—helium 3 (D—He^3), and deuterium—tritium (D—T) plasmas. It is shown that the growth rate may approach a few percent of the pump frequency at the edge, and may thus lead to edge electron heating.

58173 **Neutral-beam current-driven high-poloidal-beta operation of the DIII-D tokamak.** Simonen, T.C.; Matsuoka, M.; Bhadra, D.K.; Burrell, K.H.; Callis, R.W.; Chance, M.S.; Chu, M.S.; Greene, J.M.; Groebner, R.J.; Harvey, R.W.; and others. (General Atomics, San Diego, California 92138). *Physical Review Letters;* **61**: No. 15, 1720-1723(10 Oct 1988).

Neutral-beam current-drive experiments in the DIII-D tokamak with a single null poloidal divertor are described. A plasma current of 0.34 MA has been sustained by neutral beams alone, and the energy confinement is of H-mode quality. Poloidal β values reach 3.5 without disruption or coherent magnetic activity suggesting that these plasmas may be entering the second stability regime.

58174 **Determination of the poloidal magnetic field profiles in a tokamak by polarization spectroscopy of an impurity ion line.** Wroblewski, D.; Huang, L.K.; Moos, H.W.; Phillips, P.E. (Department of Physics and Astronomy, The Johns Hopkins University, Baltimore, Maryland 21218). *Physical Review Letters;* **61**: No. 15, 1724-1727(10 Oct 1988).

Profiles of the poloidal magnetic field in Ohmically heated, sawtoothing discharges are determined in the Texas Experimental Tokamak (TEXT) from a precise measurement of the partial circular polarization of an impurity ion line TiXVII 3834 A. The sawtooth-period—averaged safety factor (inverse of the rotational transform) on the plasma axis is found to be close to 1.0, independent of its value on the plasma edge. The measurements indicate a decoupling of the current and temperature profiles and a flat current density profile in the center of the discharge.

58175 **Quantum-electrodynamic contributions to spin—orbit splitting in the ground state of aluminumlike ions.** Kim, Y.; Sugar, J.; Kaufman, V.; Ali, M.A. (Atomic and Plasma Radiation Division, National Institute of Standards and Technology, Gaithersburg, Maryland 20899). *Journal of the Optical Society of America B: Optical Physics;* **5**: No. 10, 2225-2229(Oct 1988).

It is shown that the inclusion of quantum-electrodynamic corrections for the M-shell electrons substantially improves the agreement between multiconfiguration Dirac—Fock calculations and experimental values of the spin—orbit splitting in the ground state ($3s^2 3p\ ^2P$) of Al-like ions. Recommended values of the spin—orbit splitting are presented for Co/sup 14+/—Xe/sup 41+/.

58176 **Measurements of the ion temperature and plasma rotation from Kα emission with the TFTR horizontal x-ray crystal spectrometer.** Hsuan, H.; Bitter, M.; Rice, J.E.; Hill, K.W.; Johnson, L.; Liew, S.L.; Scott, S.D.; von Goeler, S. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08543). *Review of Scientific Instruments;* **59**: No. 10, 2127-2130(Oct 1988).

The TFTR horizontal x-ray crystal spectrometer has been improved by installation of γ and neutron shielding and is now operating in the TFTR Test Cell up to the presently maximum neutron production rates of 2 x 10^{16} neutrons/s. Further optimization by using a modified detector may assure operation of the spectrometer during the DT phase when TFTR is covered by an igloo. The instrument is set up for simultaneous observation of the entire satellite spectrum of Ni XXVII, and it provides data on the time evolution of the central ion temperature and the central plasma rotation velocity. Ion temperatures of 20—30 keV have been measured under "supershot" conditions. The highest rotation velocity observed with unidirectional injection was 1.1 x 10^6 m/s.

58177 **Measurements of radial profiles of the ion temperature and the plasma rotation velocity with the TFTR vertical x-ray crystal spectrometer.** Bitter, M.; Hsuan, H.; Rice, J.E.; Hill, K.W.; Diesso, M.; Grek, B.; Hulse, R.; Johnson, D.W.; Johnson, L.C.; von Goeler, S.; and others. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08543). *Review of Scientific Instruments;* **59**: No. 10, 2131-2134(Oct 1988).

The TFTR vertical x-ray crystal spectrometer has now been operating with three crystals and position-sensitive detectors according to the original design specifications. The observed spectra of heliumlike Ti XXI, Cr XXIII, Fe XXV, and Ni XXVII have permitted a detailed comparison with the predictions from atomic theories, and they have provided data on the radial profiles of the ion temperature and toroidal rotation velocity, as well as the radial ion charge-state distribution in TFTR discharges. Central ion temperatures of 20 keV and central plasma rotation velocities of 5 x 10^5 m/s have been recorded from plasmas with auxiliary neutral beam heating. These experimental results are presented. Also discussed are further instrumental improvements, such as the installation of two additional crystals and detectors and the installation of γ and neutron shielding, which will make it possible to measure under full DD and DT operation with 27 MW of neutral beam injection where neutron production rates of 10^{19} neutrons/s are expected.

58178 **Density profile reconstructions from 2-D interferometric data on Microtor using novel tomographic analysis techniques.** Howard, J.; Doyle, E.J.; Reibeiz, G.; Savage R.L. Jr.; Peebles, W.A.; Luhmann N.C. Jr. (Institute for Plasma and Fusion Research, University of California, Los Angeles, California 90024). *Review of Scientific Instruments;* **59**: No. 10, 2135-2138(Oct 1988).

Plasma tomographic reconstructions are subject to aliasing ambiguity as a result of the limited angular and radial sampling rates for the line-integrated data. The two-view interferometer installed on the Microtor tokamak yields unambiguous information, specifically, a collection of six low-order alias-free moments of the 2-D electron density distribution. The unspoiled coefficients can be related to physically intuitive quantities and so yield information pertinent to the equilibrium and dynamical behavior of the plasma column. Alternatively, they can be used as constraints for a maximum entropy reconstruction of the source to produce an image free of aliasing artifacts.

58179 **Broadband measurement of electron cyclotron emission in TFTR using a quasioptical light collection system and a polarizing Michelson interferometer.** Stauffer, F.J.; Boyd, D.A.; Cutler, R.C.; Diesso, M.; McCarthy, M.P.; Montague, J.; Rocco, R. (Laboratory for Plasma and Fusion Energy Studies, University of Maryland, College Park, Maryland 20742). *Review of Scientific Instruments;* **59**: No. 10, 2139-2148(Oct 1988).

For the past four years, a Fourier transform spectrometer diagnostic system, employing a fast-scanning polarizing Michelson interferometer (FMI), has been operating on the TFTR tokamak at the Princeton Plasma Physics Laboratory. It is used to measure the electron cyclotron emission (ECE) spectrum over the range 2.5—18 cm^{-1} (75—540 GHz), with a resolution of 0.123 cm^{-1} (3.7 GHz), at a rate of 72 spectra per second. The quasioptical system for collecting the light and transporting it through the interferometer to the detector has been designed using the concepts of both Gaussian and geometrical optics. The commercial FMI was custom made for this project and is the state of the art for this type of specialized instrument. The diagnostic system is described and an error propagation analysis of the absolute calibration process is given. Examples of ECE spectra measured in two polarization directions are given and electron temperature profiles derived from each of them are compared.

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REFER ALSO TO CITATION(S) 56223, 56369, 57289, 57290, 57312, 57313, 57335, 57416, 57901, 57902, 57903, 57904, 58096, 58149, 58156, 58165, 58342

58180 **(CONF-871007—105) Electromagnetic loads and structural response of the CIT [Compact Ignition Tokamak] vacuum vessel to plasma disruptions.** Salem, S.L.; Listvinsky, G.; Lee, M.Y.; Bailey, C. (TRW, Inc., Redondo Beach, CA (USA)). 1987. Contract AC05-84OR21400. 4p. NTIS, PC A02. Order Number DE89000646/JAW.

From 12. symposium on fusion engineering; Monterey, CA, USA (12 Oct 1987).

Studies of the electromagnetic loads produced by a variety of plasma disruptions, and the resulting structural effects on the compact Ignition Tokamak (CIT) vacuum vessel (VV), have been performed to help optimize the VV design. A series of stationary and moving plasmas, with disruption rates from 0.7--10.0 MA/ms, have been analyzed using the EMPRES code to compute eddy currents and electromagnetic pressures, and the NASTRAN code to evaluate the structural response of the vacuum vessel. Key factors contributing to the magnitude of EM forces and resulting stresses on the vessel have been found to include disruption rate, and direction and synchronization of plasma motion with the onset of plasma current decay. As a result of these analyses, a number of design changes have been made, and design margins for the present 1.75 meter design have been improved over the original CIT configuration. 1 ref., 10 figs., 4 tabs.

58181 **(CONF-880505—42) Tritium proof-of-principle injector experiment.** Fisher, P.W.; Milora, S.L.; Combs, S.K.; Carlson, R.V.; Coffin, D.O. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01. Order Number DE88017358/JAW.

From 3. topical meeting on tritium technology in fission, fusion and isotopic applications; Toronto, Canada (1 May 1988).

The Tritium Proof-of-Principle (TPOP) pellet injector was designed and built by Oak Ridge National Laboratory (ORNL) to evaluate the production and acceleration of tritium pellets for fueling future fision reactors. The injector uses the pipe-gun concept to form pellets directly in a short liquid-helium-cooled section of the barrel. Pellets are accelerated by using high-pressure hydrogen supplied from a fast solenoid valve. A versatile, tritium-compatible gas-handling system provides all of the functions needed to operate the gun, including feed gas pressure control and flow control, plus helium separation and preparation of mixtures. These systems are contained in a glovebox for secondary containment of tritium Systems Test Assembly (TSTA) at Los Alamos National Laboratory (LANL). 18 refs., 3 figs.

58182 **(CONF-880534—11) The ICRF antennas for TFTR.** Hoffman, D.J.; Colestock, P.L.; Gardner, W.L.; Hosea, J.C.; Nagy, A.; Stevens, J.; Swain, D.W.; Wilson, J.R. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01. Order Number DE88016886/JAW.

From 15. European conference on controlled fusion and plasma heating; Dubrovnik, Yugoslavia (16 May 1988).

Two compact loop antennas have been designed to provide ion cyclotron resonant frequency (ICRF) heating for TFTR. The antennas can convey a total of 10 MW to accomplish core heating in either high-density or high-temperature plasmas. The near-term

goal of heating TFTR plasmas and the longer-term goals of ease in handling (for remote maintenance) and high reliability (in an inaccessible tritium tokamak environment) were major considerations in the antenna designs. The compact loop configuration facilitates handling because the antennas fit completely through their ports. Conservative design and extensive testing were used to attain the reliability required for TFTR. This paper summarizes how these antennas will accomplish these goals. 5 figs, 1 tab.

58183 **(CONF-880613—22) Helium effects on neutron-irradiated Cr-Mo ferritic steels: A review of recent results.** Klueh, R.L.; Maziasz, P.J. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 41p. NTIS, PC A03/MF A01. Order Number DE89001197/JAW.

From 14. international symposium on effects of radiation on materials; Andover, MA, USA (27 Jun 1988).

Large amounts of transmutation helium will be produced in the first wall of a fusion reactor by the high-energy neutrons from the fusion reaction. Since no fusion reactor is available, the effect of simultaneous helium production and displacement damage from neutron irradiation must be simulated. One method that has been used in ferritic steels is to add nickel to the steels and irradiate them in a mixed-spectrum reactor. In such reactors, the fast neutrons produce displacement damage, while helium is produced by a two-step reaction of ^{58}Ni with thermal neutrons. This technique has been used to investigate the effect of helium on swelling, tensile properties, impact properties, and elevated-temperature embrittlement. Results indicate that helium accelerates swelling and affects tensile and impact properties of Cr-Mo ferritic steels below {approximately}450{degree}C. However, these steels are highly resistant to elevated-temperature helium embrittlement. 44 refs., 6 figs., 3 tabs.

58184 **(CONF-880812—11) Neutron irradiation of sputtered NbN films.** Weber, H.W.; Gregshammer, P.; Gray, K.E.; Kampwirth, R.T. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 5p. NTIS, PC A02. Order Number DE89000542/JAW.

From Applied superconductivity conference; San Francisco, CA, USA (21 Aug 1988).

In addition to the excellent high-field superconducting properties of NbN, it is the strain and radiation tolerance, measured in bulk NbN, which makes the material so attractive for large high-field magnets, especially for fusion applications. We report neutron irradiation experiments on sputtered NbN films, up to a fluence of 10^{23} m/sup {minus}2/ (E > 0.1 MeV, which prove that NbN films are also extremely radiation-hard high-field superconductors. Both the transition temperatures, T/sub c/, and the normal state resistivities show only small changes with neutron fluence. Concerning the critical current densities j/sub c/, degradations by as much as 30% are observed at low fields, whereas in an intermediate field range (11–15 T) virtually no change of j/sub c/ and at high fields near 20 T even an increase of j/sub c/ are found. The latter observation is ascribed to a radiation-induced increase of the upper critical field, B/sub c2/, and to the occurrence of peak effects near B/sub c2/. 14 refs., 6 figs., 1 tab.

58185 **(CONF-880812—12) Large coil task instrumentation and diagnostics: A review.** Lue, J.W.; Ellis, J.F.; Fietz, W.A.; Lubell, M.S.; Luton, J.N.; Schwenterly, S.W.; Wilson, C.T.; Wintenberg, R.E. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 5p. NTIS, PC A02. Order Number DE89001194/JAW.

From Applied superconductivity conference; San Francisco, CA, USA (21 Aug 1988).

The goal of the Large Coil Task (LCT) was to develop large toroidal superconducting magnets for fusion reactors. Each of the six coils built for this task was heavily instrumented with some 200 to 400 sensors and diagnostic voltage taps to test its performance and characteristics. In addition, more than a thousand sensors were installed in the facility and test-stand components to ensure safe and controlled operation. Through the three-year test period, some sensors worked consistently, some failed prematurely, some constantly gave useful information, some were rarely used, and others were vital in a particular test mode. This paper reviews the various type of thermometers, pressure transducers, flowmeters, strain gages, displacement transducers, acoustic emission sensors, field probes, and other diagnostic instrumentation used in LCT. The usefulness of the sensors, the difficulties with some of them, and the reliability of different groups of sensors in this task are described. 11 refs., 2 tabs.

58186 **(CONF-880929—4) Final assembly and initial operation of the advanced Toroidal Facility.** Nelson, B.E. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 9p. (CONF-880929—4). NTIS, PC A02. Order Number DE89000577/JAW.

From 15. symposium on fusion technology; Utrecht, Netherlands (19 Sep 1988).

The assembly and initial operation of the Advanced Toroidal Facility (ATF), a large torsatron designed and assembled at Oak Ridge National Laboratory, are described. The assembly process required installation of numerous components to small tolerances (<0.01 in.) and extensive testing to ensure correct fit. During initial operation, thermal and mechanical performance, displacement, and joint clamp stud tension have been measured. Comparison of these measurements with predicted values reveals generally good agreement. 8 refs., 12 figs., 1 tab.

58187 **(CONF-880929—5) Pellet injector research at ORNL.** Combs, S.K.; Foster, C.A.; Milora, S.L.; Schuresko, D.D.; Gouge, M.J.; Fisher, P.W.; Argo, B.E.; Barber, G.C.; Fehling, D.T.; Foust, C.R. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 18p. NTIS, PC A03/MF A01. Order Number DE89000659/JAW.

From 15. symposium on fusion technology; Utrecht, Netherlands (19 Sep 1988).

Advanced plasma fueling systems for magnetic confinement devices are under development a the Oak Ridge National Laboratory (ORNL). The general approach is that of producing and accelerating frozen hydrogen isotope pellets at speeds in the range 1-2 km/s and higher. Recently, ORNL provided pneumataic-based pellet fueling systems for two of the world's largest tokamak experiments, the Tokamak Fusion Test Reactor (TFTR) and the Joint European Torus (JET). A new versatile centrifuge type injector is being readied at ORNL for use on the Tore Supra tokamak. Also, a new simplified eight-shot injector design has been developed for use on the Princeton Beta Experiment (PBX) and the Advanced Toroidal Facility (ATF). In addition to these confinement physics related activities, ORNL is pursuing advanced technologies to achieve pellet velocities significantly in excess of 2 km/s and is carrying out a Tritium Proof-of-Principle (TPOP) experiment in which the fabrication and acceleration of tritium pellets have already been demonstrated. This paper describes these ongoing activities. 25 refs., 9 figs.

58188 **(CONF-881002—3) Tritium pellet injector results.** Fisher, P.W.; Bauer, M.L.; Baylor, L.R.; Deleanu, L.E.; Fehling, D.T.; Milora, S.L.; Whitson, J.C. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 22p. NTIS, PC A03/MF A01. Order Number DE88016348/JAW.

From 35. national vacuum symposium and 4th international laser science conference; Atlanta, GA, USA (2 Oct 1988).

Injection of solid tritium pellets is considered to be the most promising way of fueling fusion reactors. The Tritium Proof-of-Principle (TPOP) experiment has demonstrated the feasibility of forming and accelerating tritium pellets. This injector is based on the pneumatic pipe-gun concept, in which pellets are formed in situ in the barrel and accelerated with high-pressure gas. This injector is ideal for tritium service because there are no moving parts inside the gun and because no excess tritium is required in the pellet production process. Removal of ^{3}He from tritium to prevent blocking of the cryopumping action by the noncondensible gas has been demonstrated with a cryogenic separator. Pellet velocities of 1280 m/s have been achieved for 4-mm-diam by 4-mm-long cylindrical tritium pellets with hydrogen propellant at 6.96 MPa (1000 psi). 10 refs., 10 figs.

58189 **(CONF-881002—8) Development of a two-stage light gas gun to accelerate hydrogen pellets to high speeds for plasma fueling applications.** Combs, S.K.; Milora, S.L.; Foust, C.R.; Gouge, M.J.; Fehling, D.T.; Sparks, D.O. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 20p. NTIS, PC A03/MF A01. Order Number DE89000427/JAW.

From 35. national vacuum symposium and 4th international laser science conference; Atlanta, GA, USA (2 Oct 1988).

The development of a two-stage light gas gun to accelerate hydrogen isotope pellets to high speeds is under way at Oak Ridge National Laboratory. High velocities (>2 km/s) are desirable for plasma fueling applications, since the faster pellets can penetrate more deeply into large, hot plasmas and deposit atoms of fuel directly in a larger fraction of the plasma volume. In the initial configuration of the two-stage device, a 2.2-l volume ({<=}55-bar) provides the gas to accelerate a 25.4-mm-diam piston in a 1-m-long pump tube; a burst disk or a fast valve initiates the acceleration process in the first stage. As the piston travels the length of the pump tube, the downstream gas (initially at <1 bar) is compressed (to pressures up to 2600 bar) and thus is driven to high temperature (~5000 K). This provides the driving force for acceleration of a 4-mm pellet in a 1-m-long gun barrel. In preliminary tests using helium as the driver in both stages, 35-mg plastic pellets have been accelerated to speeds as high as 3.8 km/s. Projectiles composed of hydrogen ice will have a mass in the range from 5 to 20 mg ({rho} ~ 0.087, 0.20, and 0.32 g/cm^3 for frozen hydrogen isotopes). However, the use of sabots to encase and protect the cryogenic pellets from the high peak pressures will probably be required to realize speeds of ~3 km/s or greater. The experimental plan includes acceleration of hydrogen isotopes as soon as the gun geometry and operating parameters are optimized; theoretical models are being used to aid in this process. The hardware is being designed to accommodate repetitive operation, which is the objective of this research and is required for future applications. 25 refs., 6 figs., 1 tab.

58190 **(CONF-881015—4) Low activation materials for fusion.** Rowcliffe, A.F.; Bloom, E.E.; Doran, D.G.; Smith, D.L.; Reuther, T.C. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 8p. (IAEA-CN—50/G-3-2). NTIS, PC A02/MF A01. Order Number DE88015561/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

The viability of fusion as a future energy source may eventually be determined by safety and environmental factors. Control of the induced radioactivity characteristics of the materials used in the first wall and blanket could have a major favorable impact on these issues. In the United States, materials program efforts are focused on developing new structural alloys with radioactive decay characteristics which would greatly simplify long-term waste disposal of reactor components. A range of alloy systems is being explored in order to maintain the maximum number of design options. Significant progress has been made, and it now appears probable that reduced-activation engineering alloys with properties at least equivalent to conventional alloys can be successfully developed and commercialized. 10 refs., 1 fig.

58191 **(CONF-881031—5) Estimation of toroidal field coil stresses from magnetic loads in FER [Fusion Experimental Reactor] and NET [Next European Torus] using analytic methods.** Riemer, B.W. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 20p. NTIS, PC A03. Order Number DE88016794/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

A comparison of structural efficiency of the toroidal field (TF) coils between the Next European Torus (NET) and Fusion Experimental Reactor (FER) machines was made. The effectiveness of their winding packs to help react loads incurred from in-plane and out-of-plane electromagnetic forces was estimated. Only analytic techniques, including mechanics of materials methods and composite mixture rules, were used. The results for NET compared well with the fairly detailed (2-D) and (3-D) finite element analysis (FEA) performed by the NET team. Similar FEA of the Advanced Option C (ACS) version of FER have not been done, but the analytic results should be reasonable. The methodology used has been successfully programmed for use in reactor systems codes. 6 refs., 8 figs., 5 tabs.

58192 **(CONF-881031—6) Materials tests and analyses of Faraday shield tubes for ICRF [ion cyclotron resonant frequency] antennas.** King, J.F.; Baity, F.W.; Hoffman, D.J.; Walls, J.C.; Taylor, D.J. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 4p. NTIS, PC A02. Order Number DE88016802/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

The ion cyclotron resonant frequency (ICRF) antennas for heating fusion plasmas require careful analysis of the materials selected for the design and the successful fabrication of high integrity braze bonds. Graphite tiles are brazed to Inconel 625 Faraday shield tubes to protect the antenna from the plasma. The bond between the graphite and Inconel tube is difficult to achieve due to the different coefficients of thermal expansion. A 2-D stress analysis showed the graphite could be bonded to Inconel with a Ag-Cu-Ti braze alloy without cracking the graphite. Brazing procedures and nondestructive examination methods have been developed for these joints. This paper presents the results of our joining development and proof testing. 2 refs., 3 figs.

58193 **(CONF-881031—8) Economic implications for fusion derived from ESECOM study.** Delene, J.G.; Krakowski, R.A. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01. Order Number DE88016721/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

The main conclusion of the ESECOM study is that commercial fusion power plants have the potential to be economically competitive with present and future alternatives, while at the same time promising significant environmental and safety advantages, if designed properly. Furthermore, a range of fusion reactor approaches was identified which appears to meet these economic, safety and environmental goals. Economic competitiveness is not automatic, but depends on achieving enhanced plasma and engineering performance, such as high beta with low transport losses, efficient current drive and improved high-field coils. The main design characteristics leading to lower cost of electricity are a high degree of safety assurance compactness, improved coils, and advanced energy conversion coupled with the use of advanced fuels. 14 refs., 3 figs., 8 tabs.

58194 **(CONF-881031—16) US ITER [International Thermonuclear Experimental Reactor] shield and blanket design activities.** Baker, C.C. (Argonne National Lab., IL (USA)). Aug 1988. Contract W-31109-ENG-38. 10p. NTIS, PC A02/MF A01. Order Number DE89000540/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

This paper summarizes nuclear-related work in support of the US effort for the International Thermonuclear Experimental Reactor (ITER) Study. Primary tasks carried out during the past year include design improvements of the inboard shield developed for the TIBER concept, scoping studies of a variety of tritium breeding blanket options, development of necessary design guidelines and evaluation criteria for the blanket options, further safety considerations related to nuclear components, and issues regarding structural materials for an ITER device. The blanket concepts considered are the aqueous/Li salt solution, a water-cooled, solid breeder blanket, a helium-cooled, solid-breeder blanket, a blanket cooled by helium containing lithium-bearing particulates, and a blanket concept based on breeding tritium from He^3. 1 ref., 2 tabs.

58195 **(CONF-881031—17) Activation characteristics of different steel alloys proposed for near-term fusion reactors.** Attaya, H.; Gohar, Y.; Smith, D.; Baker, C.C. (Argonne National Lab., IL (USA)). Aug 1988. Contract W-31109-ENG-38. 8p. NTIS, PC A02/MF A01. Order Number DE89000593/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

Analyses have been made for different structural alloys proposed for the International Thermonuclear Experimental Reactor (ITER). Candidate alloys include austenitic steels stabilized with nickel (NiSS) or manganese (MnSS). The radioactivity, the decay heat, and the waste disposal rating of each alloy have been calculated for the inboard shield of the ITER design option utilizing water cooled solid breeder blanket. The results show, for the 55 cm inboard shield and after 3 MW.yr/m2 fluence, that the long term activation problems, e.g., radioactive waste, of the MnSS are much less than that of the NiSS. All the MnSS alloys considered are qualified as Class C or better low level waste. Most of the NiSS alloys are not qualified for near surface burial. However, the short term decay heat generation rate for the MnSS is much higher than that of the NiSS. 6 refs., 8 figs., 2 tabs.

58196 **(CONF-881031—18) Comparison of Nb_3Sn and NbTi superconductor magnet ITER [International Thermonuclear Experimental Reactor] devices.** Galambos, J.D.; Peng, Y.K.M.; Reid, R.L.; Lubell, M.S.; Dresner, L.; Miller, J.R. (Oak Ridge National Lab., TN (USA); Lawrence Livermore National Lab., CA (USA)). 1988. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01. Order Number DE89000656/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

The TETRA tokamak systems code is used to compare designs for the International Thermonuclear Experimental Reactor (ITER) that use Nb_3Sn and NbTi superconductor magnets. Similar minimum-cost devices are found with both types of conductors when superfluid helium (He-2) is used in conjunction with the NbTi. The cost of using NbTi with He-1 cooling is much higher than that of using Nb_3Sn or NbTi with He-2 cooling. Generally, the minimum-cost devices occur for peak fields at the toroidal field coil of about 11.5-13 T, depending on the physics requirements. Sensitivities to the allowable stress level indicate strong cost increases when the stress is reduced from the nominal 600-MPa level and weaker cost benefits when the stress is allowed to reach higher levels. 8 refs., 5 figs., 1 tab.

58197 **(CONF-881035—1) Why cryogenic ICF [Inertial Confinement Fusion] targets?.** Larsen, J.T. (KMS Fusion, Inc., Ann Arbor, MI (USA)). 1988. Contract AC03-87DP10560. 29p. NTIS, PC A03/MF A01. Order Number DE88014926/JAW.

From Topical conference on high-{Tc} superconducting thin films, devices, and characterization; Atlanta, GA, USA (3 Oct 1988).

All advanced Inertial Confinement Fusion (ICF) targets will be built with cryogenic thermonuclear fuel configurations. This paper reviews the ICF concept with emphasis on the conditions required for efficient energy production, some details of the implosion process, along with a discussion of certain sources of potential inefficiencies, and estimates of target fabrication requirements. 4 refs., 8 figs.

58198 **(DOE/ER—0313/4) Fusion reactor materials: Semiannual progress report for the period ending March 31, 1988.** (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 224p. (ORNL/M—594). NTIS, PC A10/MF A01. Order Number DE89001585/JAW.

This report contains papers on thermonuclear reactor materials. The general categories of these papers are: irradiation facilities, test matrices, and experimental methods; dosimetry, damage parameters and activation calculations; materials engineering and design requirements; fundamental mechanical behavior; development of structural alloys; solid breeding materials; ceramics; and radiation effects. Selected papers have been processed for inclusion in the energy database. (LSP)

58199 **(DOE/ET/52047—7) Review projects for the US Fusion Program: Progress report, December 1, 1984-February 28, 1987.** Ribe, F.L. (Washington Univ., Seattle (USA). Dept. of Nuclear Engineering). 15 Sep 1988. Contract AS06-78ET52047. 12p. (UWFPP—41). NTIS, PC A03/MF A01. Order Number DE88017306/JAW.

This paper reviews projects at the University of Washington on the following topics: Magnetic Fusion Energy Program Plan (Feb. 1985); High Density Power Systems; Fusion Systems Studies; Burning Plasmas and Compact Ignition Tokamak; US Magnetic Mirror Program; and Technical Planning Activity (Jan. 1987).

58200 **(GA—A19411) Resonant island divertor experiments on text.** deGrassie, J.S.; Evans, T.E.; Jackson, G.L.; Ohyabu, N.; McCool, S.C.; Gentle, K.W.; Rowan, W.L.; Wootton, A.J.; Karger, F.; Haas, G. (General Atomics Co., San Diego, CA (USA); Nagoya Univ. (Japan). Inst. of Plasma Physics; Texas Univ., Austin (USA). Fusion Research Center; Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Sep 1988. Contract AC03-84ER53158;AS05-85ER53193;AC05-78ET53043. 7p. (CONF-881015—15; IAEA-CN—50/A-VI-2-1(R)). NTIS, PC A02/MF A01. Order Number DE89000292/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

The first experimental tests of the resonant island divertor (RID) concept have been carried out on the Texas Experimental Tokamak (TEXT). Modular perturbation coils produce static resonant magnetic fields at the tokamak boundary. The resulting magnetic islands are used to guide heat and particle fluxes around a small scoop limiter head. An enhancement in the limiter collection efficiency over the nonisland operation, as evidenced by enhanced neutral density within the limiter head, of up to a factor of 4 is obtained. This enhancement is larger than one would expect given the measured magnitude of the cross-field particle transport in TEXT. It is proposed that electrostatic perturbations occur which enhance the ion convection rate around the islands. Preliminary experiments utilizing electron cyclotron heating (ECH) in conjunction with RID operation have also have been performed. 6 refs., 3 figs.

58201 **(GA-A—19399) An overview of the DIII-D long pulse neutral beam system.** Callis, R.W.; Colleraine, A.P.; Hong, R.M.; Langhorn, A.R.; Lee, R.L.; Kim, J.; Phillips, J.C.; Wight, J.J. (General Atomics Co., San Diego, CA (USA)). Sep 1988. Contract AC03-84ER51044. 7p. NTIS, PC A02/MF A01. Order Number DE89001072/JAW.

The four beamlines on the DIII-D tokamak have been upgraded to long pulse operation with the addition of eight 80 kV, 80 A, 5 sec long pulse sources. The eight sources have proven to be very reliable and have performed well. Up to 12 MW of H^0 has been injected into a plasma. Inertially cooled beam absorbers have proven capable of handling multi-second pulses. General performance characteristics and some recent long-pulse physics results are presented. 12 refs., 7 figs.

58202 **(GA-A—19404) US-Japan Workshop P-118: Vacuum technologies for fusion devices, Nagoya, Japan, [and visits to Hiroshima, Naka and Tohai], August 1--5, 1988: [Foreign] trip report.** Gallix, R. (General Atomics Co., San Diego, CA (USA)). Aug 1988. Contract AC03-84ER53158. 31p. NTIS, PC A03/MF A01. Order Number DE89000478/JAW.

I made this visit as a member of the US ITER Plasma Facing Components Design Team and as the present WBS Manager of the Vacuum Vessel and previous WBS Manager of the First Wall and Divertor for the Compact Ignition Tokamak. The main purpose of my trip was to present a communication on these CIT systems and another one on CIT In-Vessel Remote Maintenance to the US-Japan Workshop, and to participate in the workshop. The visits to Mitsubishi Heavy Industries and to JAERI's Naka and Tokai laboratories were part of the workshop program. They focus respectively on new, ceramic-rotor turbomolecular vacuum pumps; the JT-60 Tokamak and the Superconducting Magnet Laboratory; and the JFT-2M Tokamak and the Tritium Processing Laboratory.

58203 **(IAEA-TECDOC—457) Nuclear data for fusion reactor technology. Proceedings of an advisory group meeting held in Gaussig, German Democratic Republic 1-5 December 1986.** (International Atomic Energy Agency, Vienna (Austria)). Jun 1988. 252p. (CONF-861250—). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW.

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

The meeting was organized in four sessions and four working groups devoted to the following topics: Requirements of nuclear data for fusion reactor technology (6 papers); Status of experimental and theoretical investigations of microscopic nuclear data (10 papers); Status of existing libraries for fusion neutronic calculations (5 papers); and Status of integral experiments and benchmark tests (6 papers). A separate abstract was prepared for each of these papers.

58204 (IAEA-TECDOC—457, pp 23-25) **Status of differential data, theory and possibilities to meet data needs. Report of working group 2.** Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

The results of discussions concerning the status of differential data for fusion reactor technology, the possibilities of satisfying the data needs, specific recommendations concerning procedures to be followed in new measurements and some problems concerning the coordinated research programme on fusion related nuclear data measurements are summarized.

58205 (IAEA-TECDOC—457, pp 27-31) **International fusion nuclear data file. Report of working group 3.** Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

The results of discussions concerning the possibilities to create an international nuclear data file for use in fusion-reactor technology and how such a file could be organized are summarized. 3 tabs.

58206 (IAEA-TECDOC—457, pp 33-34) **IAEA sponsored international comparison of benchmark measurements and calculations. Report of working group 4.** Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

The results of discussions concerning the benchmarks which should be included in the intercomparison and the responsibilities of the IAEA are summarized. Two types of benchmarks were discussed: a calculational benchmark intended to intercompare and validate different neutron transport codes, such as experimental benchmark that would allow comparison of the experimental techniques used in different laboratories.

58207 (IAEA-TECDOC—457, pp 200-214) **Status of fusion-related evaluated nuclear data in Japan.** Kanda, Y. (Kyushu Univ., Kasuga (Japan). Dept. of Energy Conversion Engineering). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

Fusion-related evaluated nuclear data are included in Japanese Evaluated Nuclear Data Library version 3 (JENDL-3) which is progressing. The JENDL-3PR1 and -3PR2 data which are the preliminary versions of the fusion-related data for JENDL-3 are products of cooperation between evaluators and experimenters in Japan. High activities on both the differential and integral experiments in this field stimulate and encourage to improve the evaluated nuclear data. Angular and energy distributions of secondary neutrons are mainly interesting because they are essential nuclear data in the fusion blanket calculation. They are less accurate in existing evaluated files. The procedures of the evaluation for the JENDL-3PR2 data are briefly described. Another emphasized theme in JENDL-3 concerning the fusion-related nuclear data is the compilation of gamma-ray production cross sections. A plan of their evaluation is presented. The tritium production and activation cross sections are also discussed. (author). 56 refs, 26 figs, 1 tab.

58208 (IAEA-TECDOC—457, pp 9-22) **Nuclear data requirements and status of available nuclear data for integral calculations for blanket, shielding, and activation problems. Report of working group 1.** Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

Summarized in tables are the neutronic functional areas and the most important elements in the fusion reactor components, the needs and status of nuclear data for neutron transport cross sections, dosimetry reactions, activation reactions and other reactions. 6 tabs.

58209 (IAEA-TECDOC—457, pp 37-46) **Nuclear data requirements for fusion reactor transport calculations and testing of ENDF/B-V and VI libraries.** Cheng, E.T. (GA Technologies, Inc., San Diego, CA (USA)). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

We have reviewed recent fusion reactor and blanket design studies in which promising blanket concepts were identified for future development, based on the D-T fuel cycle. We have developed a list of elements whose nuclear data are needed for fusion reactor transport calculations and reviewed the status of their neutron emission data. We found that most of these data are available to 15 MeV, both in experiment and evaluation, although some discrepancies exist between the experimental and evaluated data. We have identified some elements lacking experimental data at energies below 14 MeV. We also briefly discuss the nuclear data requirements in the areas other than those for fusion reactor transport calculations. (author). 61 refs, 1 tab.

58210 (IAEA-TECDOC—457, pp 46-59) **Nuclear data requirements for tritium breeding calculations and testing of evaluated nuclear data in Japan.** Maekawa, H. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

A brief review of fusion blanket experiments and analyses in Japan is summarized as well as code developments for fusion neutronics. Nuclear data for important nuclei relevant to tritium breeding calculations is discussed. The status of these data is assessed through the analyses of integral and differential experiments. These experiments are very useful for the evaluation of methods and data. The obtained results will be applied to the evaluation of the JENDL-3 nuclear data file. (author). 113 refs, 4 figs, 4 tabs.

58211 (IAEA-TECDOC—457, pp 165-178) **Use of neutronic data in the calculations of hybrid fusion reactor blanket.** Markovskij, D.V.; Shatalov, G.E. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

A review of the integral and calculational methods for neutronic data testing that were carried out in I.V. Kurchatov Institute of Atomic Energy for the hybrid fusion reactor design is presented. (author). 33 refs, 6 figs, 3 tabs.

58212 (IAEA-TECDOC—457, pp 178-179) **Structure of working constants for neutronic calculations of fusion reactor blankets and shields by the Monte Carlo method on the basis of the evaluated data files.** Borisov, A.A.; Markovskij, D.V.; Shatalov, G.E. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

General remarks on use of nuclear data in ENDF/B-6 format for the neutronic calculations of fusion reactor blanket and shield by Monte-Carlo method are presented. (author). 6 refs.

58213 (IAEA-TECDOC—457, pp 190-200) **Status of the European fusion file.** Gruppelaar, H. (Netherlands Energy Research Foundation, Petten). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

The European Fusion File (EFF) is a nuclear-data file for application in fusion-reactor blanket design calculations, in particular for neutron-transport calculations of the Next European Torus (NET). This paper gives a status report on the EFF-project. (author). 53 refs, 7 figs, 1 tab.

58214 (IAEA-TECDOC—457, pp 217) **Comparative study of tritium breeding calculations using JEF-1 and ENDF/B-V based nuclear data libraries.** Cheng, E.T.; Pelloni, S. (GA Technologies, Inc., San Diego, CA (USA); Paul Scherrer Inst. (PSI), Wuerenlingen (Switzerland)). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

A preliminary comparative neutronics study showed that there are large discrepancies in the /sup 6/Li(n,α)T and /sup 7/Li(n,n'α)T reaction rates calculated for top-ranking fusion blanket concepts with the JEF-1 and ENDF/B-V-based nuclear data libraries. Detailed analysis is necessary and data testing integral experiments should be employed to identify the deficiencies in these nuclear data evaluations.

58215 (IAEA-TECDOC—457, pp 224-235) **LiF benchmark experiments and data analysis.** Scott, M.C. (Birmingham Univ. (UK). Dept. of Physics). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

Two sets of fusion reactor breeder-blanket integral experiments based on lithium fluoride are reviewed, namely those at the University of Birmingham and at the Tokyo Institute of Technology. The measurement procedures are outlined and the results obtained discussed, both in general terms and with respect to possible data adjustment and evaluation. Finally, some general comments are made on the utility and limitations of such measurements. (author). 32 refs, 19 figs.

58216 (IAEA-TECDOC—457, pp 236) **Neutron multiplication of lead at 14 MeV neutron incident energies.** Elfruth, T.; Seeliger, D.; Seidel, K. and others. (Technische Univ., Dresden (German Democratic Republic)). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

Neutron leakage spectra were measured with time-of-flight and with proton recoil spectroscopy and activation and fission rates were determined for a lead sphere of 4.1 mean-free path shell thickness fed in its centre with 14-MeV neutrons. The results are compared with calculations based on recent data files and are discussed in connection with previous lead benchmarks. About 10% more neutrons are observed than predicted by calculations.

58217 (IAEA-TECDOC—457, pp 236) **Neutronic integral benchmark experiments on DDX for fusion reactor design by OKTAVIAN.** Sumita, K. (Osaka Univ., Suita (Japan). Faculty of Engineering). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

To investigate adequacy and accuracy of measured data and evaluated DDX data file, several Integral Benchmark Experiments have been done for Spherical and Slab Assemblies etc. of Fusion Materials on Tritium Breeding Ratio and Neutron Transmission by OKTAVIAN. The results indicate necessity of further elaborate experimental works in this field, for reliable neutronic design, e.g., TBR in Fusion Reactor Blanket. Appendices show our latest measurements of DDX for several nuclides at a fixed neutron energy. (14.1MeV) and studies on DDX for PKA in radiation damage analysis.

58218 (IAEA-TECDOC—457, pp 237-250) **Blanket benchmark experiments and their analyses at FNS.** Maekawa, H.; Nakamura, T. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

Since the FNS, an intense 14 MeV neutron source for fusion neutronics studies, was completed in April 1981, many types of experiments have been done. Integral experiments were performed on cylindrical assemblies with 60-cm thick Li/sub 2/O, 60-cm thick graphite and 40-cm thick Li/sub 2/O followed by 20-cm thick graphite. Various reaction rates such as tritium production rate and neutron spectra were measured in these experiments. The time-of-flight experiments were conducted to measure angle-dependent neutron spectra leaking from Li/sub 2/O, graphite, Li-metal and Be-metal slab assemblies. These experiments were numerically analyzed by making use of DOT3.5, MORSE-DD and MCNP with various cross section sets based on JENDL-3PR1, -3PR2, ENDF/B-IV and -V. Another type of experiment called "Blanket Engineering-Oriented Benchmark Experiment" has been carried out as the JAERI-U.S.DOE Collaborative Program. Measured parameters such as tritium production rates and neutron spectra were analyzed by both parties. (author). 32 refs, 5 figs, 5 tabs.

58219 (IAEA-TECDOC—457, pp 60-65) **Nuclear data requirements for dosimetry and radiation damage estimates.** Greenwood, L.R. (Argonne National Lab., IL (USA)). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

Status of neutron dosimetry measurements and radiation damage calculations for the US Fusion Materials Program is presented. Nuclear data needs for fission and fusion reactors as well as requirements for damage calculations are enumerated. (author). 13 refs, figs and tabs.

58220 (IAEA-TECDOC—457, pp 180-189) **Status of the UK activation cross-section library for fusion.** Forrest, R.A. (UKAEA Harwell Lab. Nuclear Physics Div.). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

The UK is improving its fusion library (UKCTRIIIA) for activation and this involves increasing both the number of isotopes and reactions. The treatment of isomer formation is recognized as a major deficiency that requires more effort. The systematics used in the calculation of unmeasured cross sections have been reassessed and improved formulae are given here. A sensitivity analysis is planned to identify reactions that will need a more thorough treatment. A major use of these data is in the design of new alloys with low activity after irradiation; some results are given and it is stressed that the calculations will require validation. A list of areas of future work is given. (author). 29 refs, 8 figs, 2 tabs.

58221 (IAEA-TECDOC—457, pp 65-78) **Requirements for charged particle light isotopes reaction data for advanced fuel cycles including two step reaction mechanism.** Feldbacher, R.; Heindler, M.; Miley, G. (Technische Univ., Graz (Austria). Inst. fuer Theoretische Physik und Reaktorphysik; Illinois Univ., Urbana (USA). Dept. of Nuclear Engineering). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

Requirements for light charged isotopes nuclear reaction data for advanced fusion fuel cycles are identified. This is performed in the frame of the compilation of charged particle nuclear reaction data. Those reactions are considered which determine the nuclear energy production, burn kinetics, neutron- and radionuclide production among fuel and ash isotopes. Emphasis is put on the fuel p-11B for which a review of the status of existing data is given. Other exotic fuel candidates (e.g. p-6Li) and some exotic reactions occurring in D-3He based fuels are also considered, however in less detail. We conclude that there is a lack of experimental and evaluated data for several important reactions. It is recommended that evaluations be performed, existing ones reexamined, and that they are made easily accessible for the increasing number of researchers studying advanced fuels. (author). 52 refs, 10 figs, 6 tabs.

58222 (IAEA-TECDOC—457, pp 79-85) **Requirements for charged-particle reaction cross-sections in the D-D, D-T, T-T and D-/sup 3/He fuel cycles.** Jarmie, N. (Los Alamos National Lab., NM (USA)). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

This paper reviews the status of experimental data and data evaluations for charged-particle reactions of interest in fusion-reactor design. In particular, the /sup 2/H(t,α)n, /sup 2/H(d,p)/sup 3/H, /sup 2/H(d,/sup 3/He)n, /sup 3/H(t,α)nn and /sup 3/He(d,p)/sup 4/He reactions at low energies are studied. Other secondary reactions are considered. The conclusion is that such cross sections are well known for the near and medium term, and that no crucial experimental lack exists. There is a serious lack of standard evaluations of these reactions, which should be in an internationally acceptable format and easily accessible. Support for generating such evaluations should be given serious consideration. (author). 52 refs, 6 figs.

58223 (INIS-mf—11310, pp 45) **Calculation of fusion power densities of binary reactions in magnetically confined plasmas.** Triebnig, G. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

58224 (INIS-mf—11310, pp 44) **SPE - a computer code to calculate the energy spectrum of fusion products.** Kernbichler, W. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

58225 (INIS-mf—11310, pp 18) **Neutron production in fusion plasmas.** Kernbichler, W. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

58226 (INIS-mf—11310, pp 17) **Fusion power density, net power density and specific waste heat production.** Kernbichler, W. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

58227 (INIS-mf—11310, pp 16) **Maxwell-averaged reaction rate parameters.** Kernbichler, W. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

58228 (INIS-mf—11310, pp 15) **Fusion reactions between particles with charge number Z≦4.** Kernbichler, W. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

58229 (INIS-mf—11310, pp 14) **Data library for fusion physics applications.** Feldbacher, R.; Kernbichler, W. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

58230 **(INIS-mf—11310) Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.** Heindler, M.; Kernbichler, W. (eds.). (Technische Univ., Graz (Austria). Inst. fuer Theoretische Physik und Reaktorphysik). Apr 1986. 60p. (In German, English). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

38 contributions are represented in short communications, 35 of them of INIS scope. Thematically, there are two large groups: cosiderations on properties on fuel combinations other than D-T which offer advantages of lower neutron production, lower radioactivity and lower tritium inventory requirements (i.e. further steps to 'clean' fusion power) although even more difficult to realize than D-T; temporal development of nuclear power generation systems consisting of several reactors, e.g. breeder-converter systems. A last part describes the computer codes used in both fields. (qui).

58231 (INIS-mf—11310, pp 39) **COLIF - Compound light ion fuel cycle code.** Kernbichler, W. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

58232 (INIS-mf—11310, pp 20) **Processing of existing literature on the evaluation of p-/sup 11/B as fusion fuel.** Feldbacher, R. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

58233 (INIS-mf—11310, pp 19) **Tritium inventory and tritium production in fusions plasmas.** Kernbichler, W. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

58234 (INIS-mf—11310, pp 13) **Standard parameter set for a comparative evaluation of various fusion cycles.** Kernbichler, W. Apr 1986. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

58235 (INIS-mf—11310, pp 10) **Compound light ion fuel cycles.** Kernbichler, W.; Heindler, M. Apr 1986. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704030/JAW.

In Progress report 1985. Low-neutron and low-radioactivity nuclear energy, energy systems analysis.

58236 (INIS-SU—44/A, pp 9-11) **Superlattice of microinhomogeneities in laser target substance and plasma stability during spherical compression.** Borisenko, N.G.; Dorogotovtsev, V.M.; Isakov, A.I.; Merkul'ev, Yu.A.; Mikhajlov, Yu.A.; Nikitenko, A.I.; Fedotov, S.I. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780010/JAW.

Kratkie Soobshcheniya po Fizike.; (no.10).
In Experimental and theoretical physics. Collection.

Results of experimental studies on possibility to increase plasma spherical compression stability due to superlattice of microinhomogeneities inside the spherical shell target wall are presented. Suggestion of microinhomogeneous plasma effect on compression stability was proved experimentally. Method for production of glass and polymer shells, containing superlattice of microhomogeneities, are developed. It is found, that in targets with 500 μm diameter and wall thickness of 1,5 - 3,0 μm silver microimpurities with 200 A diameter and average spacing between them up to 1000 A do not deteriorate compression conditions, while microimpurities of 300-400 A diameter lead to compression degree reduction. 8 refs.; 2 figs.

58237 (INIS-SU—45, pp 18-20) **Corona model with regard to the reverse-bremsstrahlung absorption mechanism of laser radiation in plasma.** Limpoukh, I.; Lebo, I.G.; Rozanov, V.B. (Politekhnicheskij Univ., Praga). 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780096/JAW.

Kratkie Soobshcheniya po Fizike.; (no.11).
In Plasma physics. Collection.

A simplified physicomathematical model of thin shell compression by lasers is developed. A good agreement between results obtained by the model and calculation results of gas dynamics nonstationary equations is observed. The main advantages of the "Corona" model described consist in its simplicity and efficiency. Calculations by the model permit to realize target optimization in the laser fusion experiments and in the process of target and laser pulse parameter selection for perspective studies. 7 refs.; 1 tab.

58238 (INIS-SU—45, pp 57-58) **Technology of micro- and macroshells and the problem of reactor targets.** Akunets, A.A.; Dorogotovtsev, V.M.; Merkul'ev, Yu.A. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88780096/JAW.

Kratkie Soobshcheniya po Fizike.; (no.11).
In Plasma physics. Collection.

Technological principles, permitting to produce laser targets of 4.0 - 10 mm diameter are suggested. According to the given technique a particle of initial substance (drop or shell) with additions of a gas-forming agent under conditions similar to free fall, flies in the atmosphere of rarefied heat-exchange gas through a hot area. The process of its heating under conditions of a weak forced convective heat exchange is the main process taking much time. Starting heat treatment of a shell 4.0 mm in diameter with aspect ratio A = 200, i.e. thickness of 10 μm, the treatment can be finished with 10.0 mm diameter at A = 1300, i.e. with wall thickness 1.6 μm. Experimental testing has confirmed the evaluations. Shells of 4.0 mm diameter with A = 2500 are produced. 12 refs.

58239 (INIS-SU—48, pp 32-35) **Measurement of neutron leakage from /sup 238/U,/sup 232/Th,Be and Pb spherical shells with 14 MeV neutron central sources.** Zagryadskij, V.A.; Krajnev, M.I.; Markovskij, D.V.; Novikov, V.M.; Chuvilin, D.Yu.; Shatalov, G.E. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780011/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; (no.4).
In Thermonuclear synthesis. Scientific-technical collection.

The accuracy of forecasting project parameters of thermonuclear ractor (TNR) blanket depends on the authenticity of constants used in calculations. A good check-up of authenticity is provided by comparison of calculation results with results of integral experiments. The method of measuring neutron escapes from spherical assemblies (the method of /sup b/oron tank/sup)/ is briefly described. The results of measuring neutron escapes from spherical shells of different thickness from /sup 238/U, /sup 232/Th, Be and Pb with normalization for one neutron of 14 MeV sourse are presented. The comparison of experimental data with calculations according to BLANK program using constants from ENDL and UKNDL libraries has shown that the value of neutron escapes from Pb-spheres is 5.5% higher than calculated values. For Th-spheres experimental results are higher than those calculated and with the shell thickness of 10 cm the difference is 11%. Neutron escapes from U- and Be-spheres are produced in a satisfactory way in the blank program. 13 refs.; 2 tabs.

58240 (INIS-SU—48, pp 22-26) **Compensation of magnetic field corrugations for a separate coil system.** Dojnikov, N.I.; Lototskij, A.P.; Chuyanov, V.A. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780011/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; (no.4).
In Thermonuclear synthesis. Scientific-technical collection.

Compensators of magnetic field corrugation in electromagnetic system with a simple geometry are considered. The expressions to estimate resulting field disturbances when using compensating coils and ferromagnetic inserts are obtained. It is shown that these inserts narrow the working range of electromagnetic system fields in the case of effective suppression of corrugation. Estimating calculations are rather useful insetting numeric optimization problems. 9 refs.; 7 fifs.

58241 (INIS-SU—48, pp 30-31) **Sharpening of the current front of an induction storage with a two-stage plasma switch.** Dolgachev, G.I.; Golovanov, Yu.P.; Guslyakov, S.E. and others. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780011/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; (no.4).
In Thermonuclear synthesis. Scientific-technical collection.

The operation of a two-stage plasma switch (PS) is studied. The sharpening of the front of current obtained at the first cascade from 1.8 μs to 100 ns has permitted to increase the front of current rise (100 kA) in a low induction load to 40ns using another lighter cascade. The decrease of current rise time at the inlet of the second cascade has permitted to decrease the number of cannons in them from 16 to 2. In this case multiplication of strength of current by the time of its rise to the maximum in Ps, i.e. the charge for one plasma cannon is 5-10 kAxμs in both cascades. 5 refs.; 3 figs.

58242 (INIS-SU—48, pp 17-21) **Gas cooling assessment of a fusion reactor divertor plate.** Moshkin, S.A.; Murav'ev, E.V. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780011/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; (no.4).
In Thermonuclear synthesis. Scientific-technical collection.

The essential parameters of gas cooling a divertor plate with high thermal conductivity are presented. The cooling optimization has been carried out with the objective of decreasing the temperature drop along the tube circumference. 5 refs.; 5 figs.; 3 tabs.

58243 (INIS-SU—48, pp 14-17) **Calculation of fusion power plant availability.** Grigor'ev, O.V.; Murav'ev, E.V. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780011/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; (no.4).
In Thermonuclear synthesis. Scientific-technical collection.

A simplified technique of calculating the availability factor of an industrial device is suggested. A program was prepared according to this technique and implemented at computer ES in the PL-1 language which was used when calculating technical and economic characteristics of fusion tokamak reactor with 'warm' windings. 5 figs.

58244 (INIS-SU—48, pp 41-49) **Arc evaporators of titan for the Ambal-Yu vacuum system.** Bender, E.D. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780011/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; (no.4).
In Thermonuclear synthesis. Scientific-technical collection.

To place a sorbing film in built-in sorption pumps of the Ambal-Yu device extended arc evaporators consisting of rods of iodide titanium are used. To initiate arc discharge an electric breakdown over the surface of BeO insulator is used. A multiple run of

cathode spots igniting at one end of the rod and disappearing at the other end is performed. Igniting and arc damping devices are capable of providing about 10/sup 6/ working pulses. The application of molybdenum details and intermediate screens in pass-through insulators, attachment points and current supplies permit to avoid parasite arc discharges and irregular evaporator material work-out during durable exploitation under conditions of intensive evaporation of titanium vapors. 10 refs.; 9 figs.

58245 (INIS-SU—48, pp 49-51) **Power supply system for ark-type titanium evaporators of the Ambal-Yu device.** Belkin, V.S.; Bender, E.D. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780011/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; (no.4).

In Thermonuclear synthesis. Scientific-technical collection.

Requirements to the feed system and its practical realization are described. Current of arc discharge of separate evaporators are 200-300 A, current pulse duration is from 60 μs to 2 s. The feed system permits to group evaporators feeded from one rectifier and to ignite the charge on every evaporator of the group alternately and to repeat such cycles several times forming pulse packages up to 2 s. The duty factor of packages is ≧100. The consolidation into groups permits to use 26 modules of arc feed to serve 56 device evaporations. As regards scheme and construction, small sizes, simple and reliable operation were preferred to the detriment of system eficiency. 4 refs.; 2 figs.

58246 **(IPF—87-6) Optimization of oversized corrugated waveguide bends for higher-order TE/sub 0n/-modes at 140 GHz.** Jacobs, A. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Plasmaforschung). Oct 1987. 70p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755172/JAW.

Oversized corrugated 90/sup 0/ waveguide bends with a waveguide diameter of 27.79 mm were optimized for TE/sub 0n/ (n = 3...6) transmission lines to transmit power of about 200 kW for Electron-Cyclotron-Resonance-Heating of plasmas in thermonuclear fusion research at a frequency of 140 GHz. The corrugation removes the degeneracy of the mode pairs TE/sub 0n//TM/sub 1n/. The bends were optimized by numerical integration of the coupled-mode differential equations for six coupled modes: TE/sub 0n/, HE/sub 1n/, EH/sub 1n/, EH/sub 1,n+1/, HE/sub 2n/ and EH/sub 2n/. During the optimization procedure three parameters were varied: curvature distribution, corrugation depth and arc length. Following curvature distributions were studied: sine-sine-squared, triangular and specific Fourier series. The last one was found to be the best. The optimum corrugation depth increases with increasing mode number n, whereas the arc length decreases. It was found, that a small elliptical deformation of less than 0.04 mm has a negligible influence on TE/sub 03/- and TE/sub 04/-bends. In the case of TE/sub 05/- and TE/sub 06/-bends the arc length must be increased in order to maintain a pure output mode.

58247 **(IYF-R—6-272) Multicharged platinum ions in a multielement laser plasma.** Bedilov, M.R.; Bykovskij, Yu.A.; Sabitov, M.S.; Khabibullaev, B.K.; Khaitbaev, K. (AN Uzbekskoj SSR, Tashkent. Inst. Yadernoj Fiziki). 1987. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704374/JAW.

Using mass-spectrometry method charge, energy and angular distributions of Pt ions in multicomponent laser plasma have been studied. Both pure Pt and Pt bearing ore have been used as targets. On the basis of experimental results obtained a number of physical peculiarities have been observed for the Pt ions production and their expansion in multicomponent laser plasma. 7 refs.; 3 figs.

58248 **(KFK—4434) Design study on water- and gas-cooled outboard shield blankets for NET.** Bojarsky, E.; Fischer, U.; Reimann, G.; Reiser, H.; Brook, R.; Diethelm, R.; Schweizer, S.E. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Kernfusion; Sulzer Bros. Ltd., Winterthur (Switzerland)). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Kernfusion; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Kernfusion; Sulzer Bros. Ltd., Winterthur (Switzerland)). Jun 1988. 44p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755187/JAW.

The Karlsruhe Nuclear Research Center entered into an agreement with the Commission of the European Communities on execution of development work geared to shielding blankets for NET. The concept to be investigated concerned water-cooled shielding blankets and, as a backup solution, a variation with helium cooling. The NET standard version as of late 1985 was considered as the basis of the investigations. The results of the study prepared in cooperation with the Sulzer company, Winterthur, and relating to the outboard blanket are contained in this report, which shows that it is relatively easy to fabricate water-cooled blankets. The stresses acting on the material during operation as a result of temperature gradients and coolant pressure are low. By addition of lithium salts to the coolant a great potential of tritium generation is offered. On the other hand, helium cooling is associated with some difficulties in design and with higher expenditure in fabrication. However, these difficulties can probably be overcome.

58249 **(LA-UR—88-2663) Los Alamos National Laboratory plans for a laboratory microfusion facility.** Harris, D.B. (Los Alamos National Lab., NM (USA)). [1988]. Contract W-7405-ENG-36. 5p. (CONF-880967—2). NTIS, PC A02/MF A01. Order Number DE88016329/JAW.

From Fusion Power Associates annual meeting and symposium on the creation of compact, high power density plasmas; Santa Fe, NM, USA (6 Sep 1988).

Los Alamos National Laboratory is actively participating in the National Laboratory Microfusion Facility (LMF) Scoping Study. We are currently performing a conceptual design study of a krypton-fluoride laser system that appears to meet all of the diver requirements for the LMF. A new theory of amplifier module scaling has been developed recently and it appears that KrF amplifier modules can be scaled up to output energies much larger than thought possible a few years ago. By using these large amplifier modules, the reliability and availability of the system is increased and its cost and complexity is decreased. Final cost figures will be available as soon as the detailed conceptual design is complete.

58250 **(LA-UR—88-2840) The physics of the high density Z-pinch.** Glasser, A.H.; Hammel, J.E.; Lewis, H.R.; Lindemuth, I.R.; McCall, G.H.; Nebel, R.A.; Scudder, D.W.; Schlachter, J.S.; Lovberg, R.H.; Rosenau, P.; Sheehey, P.T. (Los Alamos National Lab., NM (USA); California Univ., San Diego, La Jolla (USA); Technion-Israel Inst. of Tech., Haifa; California Univ., Los Angeles (USA)). 1988. Contract W-7405-ENG-36. 11p. (CONF-881015—5; IAEA-CN—50/C-4-4-1). NTIS, PC A03/MF A01. Order Number DE88016147/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

The fiber-initiated High-Density Z-Pinch (HDZP) is a novel concept in which fusion plasma could be produced by applying 2 MV along a thin filament of frozen deuterium, 20-30 μm in diameter, 5-10 cm long. The megamp-range currents that result would ohmically heat the fiber to fusion temperatures in 100 ns while maintaining nearly constant radius. The plasma pressure would be held stably by the self-magnetic field for many radial sound transit times during the current-rise phase while, in the case of D-T, a significant fraction of the fiber undergoes thermonuclear fusion. This paper presents results of Los Alamos HDZP studies. Existing and

new experiments are described. A succession of theoretical studies, including 1D self-similar and numerical studies of the hot plasma phase, 1D and 2D numerical studies of the cold startup phase, and 3D numerical studies of stability in the hot regime, are then presented. 9 refs., 4 figs.

58251 **(LA-UR—88-2890) Edge-plasmas and wall protection in RFPs [Reversed-Field Pinch].** Werley, K.A.; Bathke, C.G.; Krakowski, R.A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 6p. (CONF-881031—11). NTIS, PC A02/MF A01. Order Number DE89000386/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

The Reverse-Field Pinch (RFP) has the ability to operate as a compact, moderate-to-high beta, high-power-density system. A compact system requires careful control of the particle and heat fluxes impinging on plasma-facing components. A strongly recycling, toroidal-field open divertor combined with a highly radiating (>90% of plasma heating power) core plasma is required. An open divertor configuration locates the plate near the field null to take advantage of the flux expansion and minimum poloidal asymmetries to minimize peak heat fluxes. The physics and engineering requirements are quantitatively discussed for an evolutionary sequence of impurity/ash-control schemes for AT-40M (0.4 MA) → ZT-P (0.08 MA) → ZTH (2-4 MA) → FTF/RFP (10 MA) → TITAN (18 MA). 13 refs., 5 figs., 2 tabs.

58252 **(LA-UR—88-2915) Recent results at the Tritium Systems Test Assembly.** Anderson, J.L.; Bartlit, J.R. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 9p. (CONF-881031—12). NTIS, PC A02/MF A01. Order Number DE89000381/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

The Tritium Systems Test Assembly (TSTA) project at Los Alamos is charged with developing and demonstrating the tritium technology required for the magnetic fusion energy program. Since June 1987 the project has been operated by Los Alamos National Laboratory under the joint funding of the US Department of Energy (DOE) and the Japan Atomic Energy Research Institute (JAERI). At TSTA the technology under development includes reactor exhaust gas processing technology and safety systems. This project is not currently investigating the processing of tritium extracted from a breeding blanket. The processing of tritium extracted from a breeding blanket is a possible upgrade to TSTA. This possible upgrade is the subject of an ongoing study among Los Alamos, JAERI and the Argonne National Laboratory (ANL). This installing such on upgraded process systems at TSTA in the 1990--1992 time frame. The exhaust gas processing system at TSTA is designed to demonstrate full-scale exhaust gas processing for a fusion machine of a size currently being designed for ITER. Of course, deuterium is also a major component of the exhaust gas. Current gas processing uses a total gas stream comprised of {approximately}65% deuterium, 35% tritium, 1-2% reactive impurities (currently nitrogen and methane) with the remaining gas hydrogen and helium. The tritium inventory required to process through this loop at this rate is about 110 g. The main process loop at TSTA has been operating at this flow rate since July 1987. In addition to the operation of the main process loop, a number of nonloop experiments are underway at TSTA. This paper will update the status of both loop and nonloop studies at Los Alamos.

58253 **(LA-UR—88-2923) The reversed-field pinch as a poloidal-field-dominated, compact, high-power-density fusion system.** Krakowski, R.A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 8p. (CONF-880967—3). NTIS, PC A02/MF A01. Order Number DE89000377/JAW.

From Fusion Power Associates annual meeting and symposium on the creation of compact, high power density plasmas; Santa Fe, NM, USA (6 Sep 1988).

This paper discusses the feasibility of reversed-field pinch devices as future thermonuclear reactors. Safety, cost, ion temperatures, Lawson numbers, and power densities are reviewed for these types of devices. 12 refs., 2 figs., 1 tab. (LSP)

58254 **(LA-UR—88-3273) Fabrication of ICF reactor targets based on symmetrization of solid fuel.** Foreman, L.R.; Hoffer, J.K. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 6p. (CONF-881056—1). NTIS, PC A02/MF A01. Order Number DE89000306/JAW.

From 19. European conference on laser interaction with matter (ECLIM); Madrid, Spain (3 Oct 1988).

Tritium self-heats at a rate of 0.97 W/mole because of its β activity. This energy drives preferential sublimation of solid T_2 or DT from regions where a layer is thicker and warmer to regions where the layer is thinner and colder. A frozen tritium layer inside an isothermal container approaches isotropy exponentially with a time constant as short as 14.4 minutes. Targets Isotropized by Radioactively Induced Sublimation (IRIS) and sized for an ICF reactor demonstrate high gain and offer real fabrication advantages. 9 refs., 2 figs.

58255 **(LA-UR—88-3296) Evaluation of the ^{7}Li(n,n't)^{4}He cross section for ENDF/B-VI and application to uncertainty analysis.** Young, P.G.; Davidson, J.W.; Muir, D.W. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 10p. (CONF-881031—14). NTIS, PC A02/MF A01. Order Number DE89000322/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

A new covariance analysis of n+^{7}Li cross section data has been completed for Version VI of ENDF/B. The analysis updates our 1981 work for ENDF/B-V.2 to include new data that has become available since that time and to incorporate cross correlations between different experiments. The bulk of the new measured data consists of some 10 new (or newly revised) tritium-production measurements involving about 70 new data points. The new analysis results in only small changes in the previous evaluation of the tritium-production cross section but significantly reduces the magnitudes of uncertainties due to the more extensive and accurate data base that was used. A two-dimensional sensitivity and uncertainty analysis of the Lithium Blanket Module experiments at the LOTUS facility was performed in order to assess the effects of the new ^{7}Li cross sections on tritium breeding uncertainty in a realistic system. 4 refs., 6 figs., 3 tabs.

58256 **(LA-UR—2743) Recent progress in the Los Alamos KrF Program.** McDonald, T.E.; Cartwright, D.C.; Coggeshall, S.V.; Fenstermacher, C.A.; Figueira, J.F.; Foreman, L.R.; Goldstone, P.D.; Hanson, D.E.; Harris, D.B.; Hauer, A.A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 8p. (CONF-881015—7; IAEA-CN—50/B272). NTIS, PC A02/MF A01. Order Number DE88016235/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

The goal of the Inertial Confinement Fusion Program (ICF) is to develop the ability to ignite and burn small masses of thermonuclear fuel. Although the present near-term objectives of the program are directed toward defense applications, ICF research continues to be carried out with a view to the longer term goal of commercial power production. The characteristics of a KrF laser make it an attractive candidate as an ICF driver. The KrF wavelength of 248 nm provides a target coupling that is very high at intensities of 10^{14} w/cm^2. In addition, the KrF laser can be repetitively operated at frequencies appropriate for a power reactor and has an intrinsically high efficiency, which allows projections to the long-term goal of energy production. The ICF program at Los Alamos consists of driver development, target design and fabrication, and target experimentation. The major effort at present is the investigation and development of KrF technology to determine its applicability for use in a laboratory driver at Los Alamos. Such a driver would be used in defense related technology studies and in areas of scientific study such as highly ionized materials and high-energy-density physics.

58257 **(ORNL—6472) Development of ferritic steels for fusion reactor applications.** Klueh, R.L.; Maziasz, P.J.; Corwin, W.R. (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 84p. NTIS, PC A05/MF A01. Order Number DE89001141/JAW.

Chromium-molybdenum ferritic (martensitic) steels are leading candidates for the structural components for future fusion reactors. However, irradiation of such steels in a fusion environment will produce long-lived radioactive isotopes that will lead to difficult waste-disposal problems. Such problems could be reduced by replacing the elements in the steels (i.e., Mo, Nb, Ni, N, and Cu) that lead to long-lived radioactive isotopes. We have proposed the development of ferritic steels analogous to conventional Cr-Mo steels, which contain molybdenum and niobium. It is proposed that molybdenum be replaced by tungsten and niobium be replaced by tantalum. Eight experimental steels were produced. Chromium concentrations of 2.25, 5, 9, and 12% were used (all concentrations are in wt %). Steels with these chromium compositions, each containing 2% W and 0.25% V, were produced. To determine the effect of tungsten and vanadium, 2.25 Cr steels were produced with 2% W and no vanadium and with 0.25% V and O and 1% W. A 9Cr steel containing 2% W, 0.25 V, and 0.07% Ta was also studied. For all alloys, carbon was maintained at 0.1%. Tempering studies on the normalized steels indicated that the tempering behavior of the new Cr-W steels was similar to that of the analogous Cr-Mo steels. Microscopy studies indicated that 2% tungsten was required in the 2.25 Cr steels to produce 100% bainite in 15.9-mm-thick plate during normalization. The 5Cr and 9Cr steels were 100% martensite, but the 12 Cr steel contained about 75% martensite with the balance delta-ferrite. 33 refs., 35 figs., 5 tabs.

58258 **(ORNL/FEDC—88/1) Radiation analysis of the CIT [Compact Ignition Tokamak] pellet injector system and its impact on personnel access.** Selcow, E.C.; Stevens, P.N.; Gomes, I.C.; Gomes, L.M. (Oak Ridge National Lab., TN (USA). Fusion Engineering Design Center). Aug 1988. Contract AC05-84OR21400. 21p. NTIS, PC A03/MF A01. Order Number DE89001144/JAW.

The conceptual design of the Compact Ignition Tokamak (CIT) is nearing completion. The CIT is a short-pulse ignition experiment, which is planned to follow the operations of the Tokamak Fusion Test Reactor (TFTR) at the Princeton Plasma Physics Laboratory (PPPL). The high neutron wall loadings, 4--5 MW/m^2, associated with the operation of this device require that neutronics-related issues be considered in the overall system design. Radiation shielding is required for the protection of device components as well as personnel. A close-in igloo shield has been designed around the periphery of the tokamak structure, and the entire experiment is housed in a circular test cell facility that has a radius of 12 m. The most critical radiation concerns in the CIT design process relate to the numerous penetrations in the device. This report discusses the impact of a major penetration on the design and operation of the pellet injection system in the CIT. The pellet injector is a major component, and it has a line-of-sight penetration through the igloo and test cell wall. All current options for maintenance of the injector require hands-on-access. A nuclear analysis has been performed to establish the feasibility of hands-on-access. A coupled Monte Carlo/discrete-ordinates methodology was used to perform the analysis. This problem is characterized by deep penetration and streaming with very large length-to-diameter ratios. Results from this study indicate that personnel access to the pellet injector glovebox is possible. 14 refs., 3 figs., 3 tabs.

58259 **(PPPL—2550) Amplitude and phase detector for radio frequency measurements.** Cutsogeorge, G. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Sep 1988. Contract AC02-76CH03073. 12p. NTIS, PC A03/MF A01. Order Number DE89001173/JAW.

A module has been designed that may be used to demodulate amplitude and phase information in radio frequency systems. This design has been used on PLT and is currently in use on TFTR. 8 figs.

58260 **(SAND—88-0414C) Critical heat flux investigations for fusion-relevant conditions with the use of a rastered electron beam apparatus.** Koski, J.A.; Croessmann, C.D. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 20p. (CONF-881120—13). NTIS, PC A03/MF A01. Order Number DE89001120/JAW.

From ASME winter annual meeting; Chicago, IL, USA (28 Nov 1988).

With the use of a rastered electron beam apparatus, investigations of critical heat flux (CH) and associated noise, pressure and flow spectra have been completed for water-cooled test targets under conditions relevant to the design of high-heat-flux components for fusion energy applications. Targets tested were copper tubes with attached graphite armor tiles. Water flows with velocities ranging from 3 to 10 m/s were used, with axially uniform heat fluxes ranging from 10 to 60 MW/m^2 applied along only one side of the tube to simulate the heating pattern often encountered by plasma facing components in fusion applications. Targets included stainless steel twisted tapes mechanically locked into the tube bore to increase CH levels. Exit conditions typical of highly subcooled flow boiling were considered, e.g., exit qualities of about {minus}0.3, with exit pressures near 1 MPa, and exit temperatures in the 30 to 40 C range. Besides observation of CHF and the comparison to CHF correlations, the studies also examined possible means for predicting and preventing tube burnout. Diagnostics tried included acoustic amplitude and spectra in both the audible and above audible frequency ranges, exit pressure amplitude and spectra, and flow variations and spectra. During testing, signals from the diagnostics showed a large increase in amplitude before CHF occurred. 13 refs., 9 figs.

58261 **(SAND—88-1111C) Design issues for a light ion beam LMF [Laboratory Microfusion Facility] driver.** Ramirez, J.J.; Stinnett, R.W.; Johnson, D.L.; Olson, C.L.; Mehlhorn, T.A.; Crow, J.T.; Quintenz, J.P.; Prestwich, K.R.; Desjarlais, M.P.; Olson, R.E.; Allshouse, G.O.; Martin, T.H.; VanDevender, J.P.; Cook, D.L.; Slutz, S.A.; Coachman, K.B.; Lockner, T.R.; Turman, B.N.; Goldstein, S.A.; Olsen, J.N.; Peterson, R.R.; Engelstad, R.L. (Sandia National Labs., Albuquerque, NM (USA); Wisconsin Univ., Madison (USA)). 1988. Contract AC04-76DP00789. 16p. (CONF-881031—19). NTIS, PC A03/MF A01. Order Number DE89001158/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

The US Department of Energy is conducting a preliminary study of a Laboratory Microfusion Facility (LMF). A major goal of the LMF is the development of high-gain ICF targets in a laboratory environment. Light ion beams are a candidate for the LMF driver. This paper discusses initial results from a study of a light ion beam driver for the LMF. An overview of the LMF design concept is presented together with key design issues for the various subsystems. 15 refs., 6 figs., 4 tabs.

58262 **(SAND—88-1779) Integrated diagnostic package for intense proton and lithium beam measurements on Sandia National Laboratories' PBFA-II accelerator.** Leeper, R.J.; Stygar, W.A.; Maenchen, J.; Ruiz, C.L.; Kensek, R.P.; Bailey, J.; Cooper, G.; Johnson, D.J.; Lee, J.R.; Lockner, T.R. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 16p. (CONF-881151—1). NTIS, PC A03/MF A01. Order Number DE88017345/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

A review of the diagnostics used at Sandia National Laboratories to measure the parameters of intense proton and lithium beams generated on the PBFA-II accelerator will be presented. These diagnostics consist of several types, namely: Kα x-ray pinhole cameras, a multiframe dE/dx ion pinhole camera, a p-i-n array ion pinhole camera, Thomson parabola spectrographs, a Rutherford magnetic spectrograph, plasma visible spectroscopy, and several nuclear activation diagnostics. These components when taken together provide a rather thorough description of the 5-MV, 10-TW ion beams presently being produced. Specifically, the beam parameters measured by the diagnostic array include spatial profile (off and on axis), absolute number, species, voltage, current density, and focal power density. A unique feature of these diagnostics is that they are capable of operating in hard (several MeV) x-ray bremsstrahlung backgrounds of some 10^9 {minus} 10^{11} Rad/s. The operating principles of each diagnostic will be summarized in the paper, along with a discussion of how the diagnostics are integrated together to form a complete system. The paper will close with a discussion of a new

nuclear track counting system that has been developed for automatic counting of solid-state nuclear track detectors. 14 refs., 4 figs.

58263 (SAND—88-2432C) Progress toward inertial fusion with light ion beams at Sandia National Laboratories. Vandevender, J.P.; Bailey, J.E.; Bieg, K.W.; Cook, D.L.; Crow, J.T.; Desjarlais, M.P.; Gerber, R.A.; Goldstein, S.A.; Hamil, R.A.; Holman, G.T. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 10p. (CONF-881015—8; IAEA-CN—50/B-2-5). NTIS, PC A02/MF A01. Order Number DE88016693/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

Inertial Confinement Fusion driven by lithium ion beams is being pursued on the Particle Beam Fusion Accelerator II at Sandia National Laboratories. Reliably synchronizing the 36 pulsed power modules has allowed the experiments on ion beam production and focusing to progress at the rate of one test per day. The accelerator has been operated at reduced energy to reproduce and extend the data base from previous accelerators. In this mode, 500 kJ are coupled to the diode, 425 kJ to the ion beam, 220 kJ to a single species, but only 75 kJ to the target. Solenoidal lens bending and diode impedance collapse from magnetic field diffusion into the anode plasma explain the inefficiency. The horizontal beam divergence needed for ignition (20 mrads) has been achieved. The divergence is smallest with small gaps between the anode and the virtual cathode. A 10% full width at half maximum variation in the instantaneous ion beam energy is recorded. The results are consistent with an electromagnetic instability, although other explanations are possible. The data and associated theory indicate that very high current density diode operation is desirable for efficient beam generation and focusing. The light ion approach to a Laboratory Microfusion Facility that will produce a range of thermonuclear yields from 200 to 1000 MJ is based on the magnetically insulated linear induction accelerator concept recently tested in Hermes III. 20 refs.

58264 (SAND—88-2441C) Results in Ion Hose Detuning Theory. O'Brien, K.J. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 5p. (CONF-8809149—3). NTIS, PC A02/MF A01. Order Number DE89000455/JAW.

From DARPA/SDIO services annual propagation review; Newport, RI, USA (12 Sep 1988).

This paper discusses the feedback and stochastic stabilization of ion hose. 2 refs.

58265 (SAND—88-2707C) Progress in light ion fusion. VanDevender, J.P. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 4p. (CONF-880967—4). NTIS, PC A02/MF A01. Order Number DE89001043/JAW.

From Fusion Power Associates annual meeting and symposium on the creation of compact, high power density plasmas; Santa Fe, NM, USA (6 Sep 1988).

This paper discusses the progress on the particle beam fusion accelerator II. Transformer design, plasma opening switches, beam steering and lithium ion sources, ignition targets and other related topics are briefly discussed.

58266 (SAND—88-2765C) Development and testing of high-heat-flux components for the Tore Supra horizontal pump limiter module. Koski, J.A.; Hosking, F.M.; Watson, R.D.; Croessmann, C.D. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 14p. (CONF-880929—6). NTIS, PC A03/MF A01. Order Number DE89001187/JAW.

From 15. symposium on fusion technology; Utrecht, Netherlands (19 Sep 1988).

The actively cooled pump limiter module located at the horizontal midplane of the Tore Supra Tokamak is designed for 2 MW of steady state power removal. For a thin (2.5 cm thick) limiter head which maximizes pumping and particle removal, this power load results in surface heat fluxes near 30 MW/m² at the leading edge and 10 MW/m² for the front surface. The initial design configuration for the high-heat-flux surfaces consisted of pyrolytic graphite armor tiles brazed to alumina dispersion strengthened copper tubes. Subsequent finite element analyses and braze tests showed that direct bonding of the highly anisotropic pyrolytic graphite to the strong (400 MPa yield strength) copper alloy led to cracking in the pyrolytic graphite tiles and a significant reduction in heat removal capabilities. To eliminate the graphite cracking problem, various compliant interlayers between the copper tube and the armor tile were tried. Interlayers tested included OFHC copper and several types of copper feltmetal. The resulting brazes were evaluated with metallurgical laboratory techniques and by testing at design heat fluxes with the use of a rastered electron beam apparatus. This paper describes the development and testing effort which solved the brazing difficulites, and resulted in a design capable of meeting design goals. 7 refs., 5 figs.

58267 (UCRL—98504) Acceleration of compact toroid plasma rings for fusion applications. Hartman, C.W.; Barr, W.L.; Eddleman, J.L.; Gee, M.; Hammer, J.H.; Ho, S.K.; Logan, B.G.; Meeker, D.J.; Mirin, A.A.; Nevins, W.M. (Lawrence Livermore National Lab., CA (USA)). 26 Aug 1988. Contract W-7405-ENG-48. 15p. (CONF-881015—12). NTIS, PC A03/MF A01. Order Number DE88017165/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

We describe experimental results for a new type of collective accelerator based on magnetically confined compact torus (CT) plasma rings and discuss applications to both inertial and magnetic fusion. We have demonstrated the principle of CT acceleration in the RACE device with acceleration of 0.5 mg ring masses to 400 km/s and 0.02 mg ring masses to 1400 km/s at ≧30% efficiency. Scaling the CT accelerator to the multi-megajoule level could provide an efficient, economical driver for inertial fusion (ICF) or magnetically insulated inertial fusion. Efficient conversion to x-rays for driving hohlraum-type ICF targets has been modeled using a radiation-hydrodynamics code. At less demanding conditions than required for ICF, a CT accelerator can be applied to fueling and current drive in tokamaks. Fueling is accomplished by injecting CTs at the required rate to sustain the particle inventory and at a velocity sufficient to penetrate to the magnetic axis before CT dissolution. Current drive is a consequence of the magnetic helicity content of the CT, which is approximately conserved during reconnection of the CT fields with the tokamak. Major areas of uncertainty in CT fueling and current drive concern the mechanism by which CTs will stop in a tokamak plasma and the effects of the CT on energy confinement and magnetic stability. Bounds on the required CT injection velocity are obtained by considering drag due to emission of an Alfven-wave wake and rapid reconnection and tilting on the internal Alfven time scale of the CT. Preliminary results employing a 3-D, resistive MHD code show rapid tilting with the CT aligning its magnetic moment with the tokamak field. Requirements for an experimental test of CT injection and scenarios for fueling a reactor will also be discussed. 14 refs., 4 figs.

58268 (UCRL—98540) Inertial fusion results from Nova and implication for the future of ICF. Kilkenny, J.D.; Cable, M.D.; Campbell, E.M.; Coleman, L.W.; Correll, D.L.; Drake, R.P.; Ellis, R.J.; Glendinning, S.G.; Hatcher, C.W.; Hatchett, S.P. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 22p. (IAEA-CN—50/B-1-3; CONF-881015—20). NTIS, PC A03/MF A01. Order Number DE89001297/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

A key objective of the US Inertial Confinement Fusion Program is to obtain high yield (100-1000 MJ) implosions in a laboratory environment. This requires high grain from an inertial fusion target from a driver capable of delivering about 10 MJ. Recent results have been sufficiently encouraging that the US Department of Energy is planning for such a capability called the Laboratory Microfusion Facility (LMF). In the past two years, we have conducted implosion-related experiments with approximately 20 kJ of 0.35-μm laser light in 1-ns temporally flat-topped pulses. These experiments were done with the Nova laser, the primary US facility devoted to radiatively driven inertial confinement fusion. Our results show that we can accurately model a significant fraction of the phenomena required to obtain the fuel conditions needed for high gain. Both the x-ray conversion efficiency and the growth of Ray-

leigh-Taylor hydrodynamic instabilities are shown to be at acceptable levels. Targets designed so that the shape of the stagnated fuel can be imaged show that the x-ray drive in our hohlraums can be made isotropic to better than 3%. With this optimized drive and temporally unshaped laser pulses many critical implosion parameters are measured on targets designed for higher density. Good agreement is obtained with one-dimensional simulations. Maximum compressions of between 20--30 in radius are measured with a variety of diagnostics. Improvements in the driver technology are demonstrated; we anticipate operation of Nova at the 50-kJ level at 3ω. 18 refs., 6 figs., 1 tab.

58269 **(UCRL—98634) Summary of the US Senior Committee on Environmental, Safety, and Economic Aspects of Magnetic Fusion Energy (ESECOM).** Logan, B.G.; Holdren, J.P.; Berwald, D.H.; Budnitz, R.J.; Crocker, J.G.; Delene, J.G.; Endicott, R.D.; Kazimi, M.S.; Krakowski, R.A.; Schultz, K.R. (Lawrence Livermore National Lab., CA (USA)). 15 Aug 1988. Contract W-7405-ENG-48. 13p. (CONF-881015—13; IAEA-CN—50/G-1-5). NTIS, PC A03/MF A01. Order Number DE88017011/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

ESECOM has completed a recent assessment of the competitive potential of magnetic fusion energy (MFE) compared to present and future fission energy sources giving particular emphasis to the interaction of environmental, safety, and economic characteristics. By consistently applying a set of economic and safety models to a set of MFE concepts using a wide range of possible material choices, power densities, power conversion methods, and fuel cycles, ESECOM finds that several different MFE concepts have the potential to achieve costs of electricity comparable to those of fission systems, coupled with significant safety and environmental advantages. 13 refs., 7 tabs.

58270 **Impedance matched, high-power, RF antenna for ion cyclotron resonance heating of a plasma.** Baity, F.W. Jr.; Hoffman, D.J.; Owens, T.L. (to Dept. of Energy, Washington, DC). US Patent 4,755,345. 5 Jul 1988. Filed date 1 Aug 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

An antenna is described for radiating rf energy into a magnetically confined plasma within a vacuum vessel which consists of an inductive rf energy radiating element having a length substantially shorter than a half wavelength of the rf wavelength and disposed adjacent to the plasma; first and second variable capacitors connected respectively between opposite ends of the radiating element and a common connecting point; an input coaxial feedline having an outer conductor connected to the common connecting point of the first and second capacitors and an inner conductor connected to the radiating element at a fractional distance α of the length of the radiating element from one end of the radiating element to provide a real input impedance for the antenna which is matched to the input feedline impedance for feeding power to the antenna at a selected operating frequency in a manner to form first and second resonant loops having essentially equal currents I/sub 1/ and I/sub 2/, respectively; a drive means coupled to the first and second capacitors for varying the capacitances thereof so that the input impedance of the antenna may be varied to match the impedance of the coaxial feedline while maintaining resonance in the first and second resonant loops; and a vacuum sealed housing means for vacuum sealed mounting of the antenna in an access port of the vacuum vessel.

58271 **Method and apparatus for the production of cluster ions.** Friedman, L.; Beuhler, R.J. (to Dept. of Energy, Washington, DC). US Patent 4,755,344. 5 Jul 1988. Filed date 22 Dec 1982. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

An apparatus is described for the production of large hydrogen or deuterium cluster ions of narrow mass distribution comprising: (a) a source of purified hydrogen gas cooled to temperatures below 30° K. and held at a predetermined pressure; and (b) means for ionizing the gas, the ionizing means being located so as to minimize the formation of impurities through chemical reactions and so as to create such ionized gas immediately upstream of a supersonic nozzle, the nozzle being about 0.002 inches thick in its axial direction to prevent its becoming insulated through deposit of impurities or reaction products thereon and the nozzle opening into a first region that is maintained at a low pressure relative to the predetermined pressure.

58272 **Hybrid-drive implosion system for ICF targets.** Mark, J.W.K. US Patent Application 6-108,183. 14 Oct 1987. 16p. Contract W-7405-ENG-48. NTIS, PC A03/MF A01.

Hybrid-drive implosion systems for ICF targets are described which permit a significant increase in target gain at fixed total driver energy. The ICF target is compressed in two phases, an initial compression phase and a final peak power phase, with each phase driven by a separate, optimized driver. The targets comprise a hollow spherical ablator surroundingly disposed around fusion fuel. The ablator is first compressed to higher density by a laser system, or by an ion beam system, that in each case is optimized for this initial phase of compression of the target. Then, following compression of the ablator, energy is directly delivered into the compressed ablator by an ion beam driver system that is optimized for this second phase of operation of the target. The fusion fuel is driven, at high gain, to conditions wherein fusion reactions occur. This phase separation allows hydrodynamic efficiency and energy deposition uniformity to be individually optimized, thereby securing significant advantages in energy gain. In additional embodiments, the same or separate drivers supply energy for ICF target implosion. 3 figs.

58273 **Differential atmospheric tritium sampler.** Griesbach, O.A.; Stencel, J.R. US Patent Application 6-103,863. 2 Oct 1987. 20p. Contract AC02-76CH03073. NTIS, PC A03/MF A01.

An atmospheric tritium sampler is provided which uses a carrier gas comprised of hydrogen gas and a diluting gas, mixed in a nonexplosive concentration. Sample air and carrier gas are drawn into and mixed in a manifold. A regulator meters the carrier gas flow to the manifold. The air sample/carrier gas mixture is pulled through a first moisture trap which adsorbs water from the air sample. The moisture then passes through a combustion chamber where hydrogen gas in the form of H_2 or HT is combusted into water. The manufactured water is transported by the air stream to a second moisture trap where it is adsorbed. The air is then discharged back into the atmosphere by means of a pump.

58274 **Low density microcellular carbon or catalytically impregnated carbon foams and process for their preparation.** Hooper, R.W.; Pekala, R.W. US Patent Application 6-044,253. 30 Apr 1987. 30p. Contract W-7405-ENG-48. NTIS, PC A03/MF A01.

Machinable and structurally stable, low density microcellular carbon, and catalytically impregnated carbon, foams, and process for their preparation, are provided. Pulverized sodium chloride is classified to improve particle size uniformity, and the classified particles may be further mixed with a catalyst material. The particles are cold pressed into a compact having internal pores, and then sintered. The sintered compact is immersed and then submerged in a phenolic polymer solution to uniformly fill the pores of the compact with phenolic polymer. The compact is then heated to pyrolyze the phenolic polymer into carbon in the form of a foam. Then the sodium chloride of the compact is leached away with water, and the remaining product is freeze dried to provide the carbon, or catalytically impregnated carbon, foam.

58275 **Method of forming ceramic bricks.** Poeppel, R.B.; Claar, T.D.; Silkowski, P. US Patent Application 6-041,266. 22 Apr 1987. 10p. Contract W-31109-ENG-38. NTIS, PC A02.

A method for forming free standing ceramic bricks for use as tritium breeder material is disclosed. Aqueous solutions of sodium carbonate and potassium carbonate are mixed with an organic hydrocolloid dispersion and powdered lithium carbonate, spray dried, and ceramic bricks formed by molding in a die and firing.

58276 **Laser or charged-particle-beam fusion reactor with direct electric generation by magnetic flux compression.** Lasche, G.P. US Patent Application 6-016,903. 20 Feb 1987. 123p. Contract W-7405-ENG-48. NTIS, PC A06/MF A01.

A high-power-density-laser or charged-particle-beam fusion reactor system maximizes the directed kinetic energy imparted to a large mass of liquid lithium by a centrally located fusion target. A fusion target is embedded in a large mass of lithium, of sufficient radius to act as a tritium breeding blanket, and provided with ports for the access of beam energy to implode the target. The directed kinetic energy is converted directly to electricity with high efficiency by work done against a pulsed magnetic field applied exterior to the lithium. Because the system maximizes the blanket thickness per unit volume of lithium, neutron-induced radioactivities in the reaction chamber wall are several orders of magnitude less than is typical of other fusion reactor systems. 25 figs.

99 GENERAL AND MISCELLANEOUS

REFER ALSO TO CITATION(S) 58316

58277 **(LA-UR—88-2550) The high-technology classroom: A preview of coming attractions.** Trainor, M.S.; Andrews, A.E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 8p. (CONF-881173—2). NTIS, PC A02/MF A01. Order Number DE88016229/JAW.

From 30. international conference of the Association for the Development of Computer-Based Instructional Systems (ADCIS); Philadelphia, PA, USA (7 Nov 1988).

The focus of this paper is on computer usage and the computer's impact on the functionality and design of the classroom. In particular, we focus on how a classroom can be designed or redesigned to maximize the potential of both the instructor and the computer to provide the best instructional experience for students. Although the lecture mode of instruction is not expected to be abandoned, the role of the instructor is changing from a font of information to a learning facilitator with tools to aid in that facilitation. The design of a high technology classroom is provided in the paper, along with some examples of use of the classroom. Central to this design are emerging technologies. The paper provides a guideline for institutions considering updating their facilities. 2 refs., 1 fig.

9901 Management

REFER ALSO TO CITATION(S) 56680, 58298

58278 **(BNL—41459) New initiative for QA in advanced energy: A realistic approach to quality assurance in basic research.** Shear, M.; Bebon, M.J. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 8p. (CONF-881077—8). NTIS, PC A02/MF A01. Order Number DE88015850/JAW.

From 15. annual national Energy Division conference; San Antonio, TX, USA (23 Oct 1988).

This paper will describe how quality assurance concepts and good basic research practice can be melded together to improve research quality without inhibiting creativity. It presents a realistic discussion of how quality is assured during the four major activities of basic scientific research: selecting the researchers; choosing the topic or area to be investigated; conducting the investigation; and documenting the results.

58279 **(CONF-881090—2) Obligation and outlay forecasting system.** Emrich, M.L.; Hardee, H.K.; Jairam, B.N.; Morris, J.D.; Jones, K.A. (Oak Ridge National Lab., TN (USA)). 29 Apr 1988. Contract AC05-84OR21400. 12p. NTIS, PC A03/MF A01. Order Number DE88015282/JAW.

From 3. international symposium on methodologies for intelligent systems; Charlotte, NC, USA (12 Oct 1988).

The Office of the Director of the Budget is responsible for pricing Air Force programs. Throughout the year, budget analysts are required to prepare three cost exercises: The Program Objective Memorandum (POM), the Budget Estimate Submission (BES), and the President's Budget (PB). During budget planning and execution, analysts must make decisions regarding funding obligations and outlays. Analysis and modification of projected obligations and outlays require the use of operational and procedural heuristics. The problem-solving steps followed by analysts are being used to develop a prototype. Information regarding the prototype's structure and tool used for development is presented. 8 refs.

58280 **(EPRI-EM—5842) Moving toward integrated value-based planning: The issues.** Chamberlin, J.H.; Braithwait, C.L. (Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA)). Jul 1988. 526p. (CONF-8712119—). Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI88016610/JAW.

From Moving toward integrated value-based planning the issues; New Orleans, LA, USA (1 Dec 1987).

Integrated Value-Based Planning (IVP) is a promising new planning approach that uses value, as well as cost, as the common denominator for evaluating supply and demand resource options. Planning based on value yields an "apples to apples" comparison of utility and customer options. The IVP approach can form the cornerstone of a successful market-driven utility planning strategy. This conference will raise questions, discuss issues, and further the exchange of information regarding the tools, concepts, and techniques needed to put IVP into the utility planner's toolbox. This proceedings is more than a compendium of papers. It is designed to let both participants and non-participants exchange information. To this end, listings and cross-listings of papers, speakers and participant interest areas, along with the ever-invaluable phone number have been included.

58281 **(NORDITA—86/24(prepr.)) How NORDITA came into being. Speech on the occasion of the 25th anniversary, October 1, 1982.** Gustafson, T. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). 1986. 16p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755263/JAW.

On the occasion of the 25th anniversary of NORDITA the history of this institution starting from the Niels Bohr Institute is described. (HSI).

58282 **(OEFZS-A—1147) Radiation protection safety report of the research centre Seibersdorf for the year 1987. Results of personnel and working place monitoring, emission and environmental monitoring.** Mueck, K.; Steger, F.; Hefner, A. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Strahlenschutz). (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Mar 1988. 64p. (In German). (ST—152/88). Austrian Research Centre Seibersdorf, A-2444 Seibersdorf, Austria.

Limited distribution.

The safety report of the Institute for Radiation Protection comprises all measurements which have been performed during the year 1987 to protect the employees and the environment of the Research Centre Seibersdorf. Personnel monitoring was carried out by TL-dosimetry to control the external dosis, by body counting and excretion analysis for the surveillance of internal exposure according to the Austrian Radiation Protection Law. Persons working in areas of increased exposure risk were additionally surveilled by dosimeters with continuous display. Monitoring of working places was performed by smear tests and measurement of activity concentration in air. The radio-activity emitted from the ASTRA-reactor, the SAL, the waste-incineration plant and other institutes as well as the radioactive effluents from the water treatment plant were monitored. Beyond this, the environmental surveillance was supplemented by measurements of the activity content of surface air, tap-and surface water, soil and vegetation samples. The result of the environmental surveillance proves that in the year of 1987 no employee or personal of other firms was exposed to a dose above the limits set in the Austrian code of regulations. On the contrary, the maximum annual dose amounted to less than 20% of the regulatory maximum value. The average dose 1,19mSv (119mrem), about 1/40 of the annual limits. The releases to the environment were also well below the limits set by the authorities. This is also demonstrated by measurements in the environment which prove that no influence of the Research Centre on the environment is detectable. Since up to

now all employees in the Research Centre, e.g. also those working in 'non-active' areas, are surveilled by TL-dosimeters, the averaged dose value for those persons working in 'active' areas shall be also given for comparison. It amounts to 1,38mSv/a (138mrem/a) for a collective of 353 persons. 22 tabs., 14 figs.

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REFER ALSO TO CITATION(S) 56764

58283 **(AD-A—195071/6/XAB) Role of PROLOG (Programming and Logic) in natural-language processing. Report for September-December 1987.** McHale, M.L. (Air Force Rome Air Development Center, Griffiss AFB, NY (USA)). Mar 1988. 35p. (RADC-TR—88-74). NTIS, PC A03/MF A01.

The field of artificial Intelligence strives to produce computer programs that exhibit intelligent behavior. One of the areas of interest is the processing of natural language. This report discusses the role of the computer language PROLOG in Natural Language Processing (NLP) both from theoretic and pragmatic viewpoints. The reasons for using PROLOG for NLP are numerous. First, linguists can write natural-language grammars almost directly as PROLOG programs; this allows fast-prototyping of NLP systems and facilitates analysis of NLP theories. Second, semantic representations of natural-language texts that use logic formalisms are readily produced in PROLOG because of PROLOG's logical foundations. Third, PROLOG's built-in inferencing mechanisms are often sufficient for inferences on the logical forms produced by NLPs. Fourth, the logical, declarative nature of PROLOG may make it the language of choice for parallel computing systems. Finally, the fact that PROLOG has a de facto standard (Edinburgh) makes the porting of code from one computer system to another virtually trouble free. Perhaps the strongest tie one could make between NLP and PROLOG was stated by John Stuart Mill in his inaugural Address at St. Andrews: The structure of every sentence is a lesson in logic.

58284 **(AD-A—195119/3/XAB) Optics and symbolic computing. Semiannual report, 14 August 1987-31 March 1988.** Athale, R. (BDM Corp., Vienna, VA (USA)). 31 Mar 1988. 64p. (BDM/MCL—88-0182-TR). NTIS, PC A04/MF A01.

Sorting is central to the solution of many knowledge-based and switching problems in advance computation and communication systems. Parallel-pipelined sorting algorithms are appropriate for applications that demand high throughput, low delay, and many data channels. One such algorithm, the bitonic sor, can be implemented with passive perfect shuffle interconnects between active stages of compare-and-exchange elements. This paper focuses on optical hardware to implement the C&E operation and show that by taking advantage of a distinctive feature of optical logic, namely bistability, comparison circuits of remarkable simplicity are attainable. Described are implementations of C&E in a Variety of optical device technologies capable of performing latching and nonlatching logic. Based on the device characteristics potential application areas for each technology are outlined.

58285 **(AD-A—195152/4/XAB) Reducing the parallel solution time of sparse circuit matrices using reordered Gaussian elimination and relaxation.** Smart, D.; White, J. (Massachusetts Inst. of Tech., Cambridge (USA). Microsystems Research Center). Mar 1988. 14p. (VLSI-MEMO—88-440). NTIS, PC A03/MF A01.

Using parallel processors to reduce the execution times of classical circuit simulation programs like SPICE and ASTAP has been the focus of much current research. In these efforts, good parallel speed increases have been achieved for linearized system construction, but it has been difficult to get good parallel speed increases for sparse matrix solution. This paper examines two approaches for reducing parallel sparse-matrix solution time; the first based on pivot-ordering algorithms for Gaussian elimination, and the second based on relaxation algorithms. The section on Gaussian elimination sparse-matrix solution presents a pivot-ordering algorithm that increases the parallelism of Gaussian elimination compared to the commonly used Markowitz method. The performance of the new algorithm is compared to other suggested ordering algorithms for a collection of circuit examples. The minimum number of parallel steps for the solution of a tridiagonal matrix is derived, and it is shown that this optimum is nearly achieved by the ordering heuristics that attempt to maximize parallelism. The section on relaxation presents an optimality result about Gauss-Jacobi over Gauss-Seidel relaxation on parallel processors.

58286 **(AD-A—195407/2/XAB) Center on communications, control, and computation. Final report, 1 January 1984-31 December 1987.** Mitter, S.K. (Massachusetts Inst. of Tech., Cambridge (USA). Lab. for Information and Decision Systems). 6 Apr 1988. 39p. NTIS, PC A03/MF A01.

During the grant period, research was conducted on many fundamental aspects of communication, control and computation. The report summarizes some of the results achieved in the following areas: i) Parallel and Distributed Computation, ii) Communication Aspects of Parallel and Distributed Computation, iii) Convergence Analysis for Partially Asynchronous Algorithms, iv) Communication, v) Efficient Algorithms for Solving Elliptic PDEs, vi) Multisource Array Processing, vii) Estimation and Modeling of Spatially-Distributed Data, viii) Singularly Perturbed Systems, ix) Discrete Event Systems, x) Decentralized Detection, xi) Markov Chains and Simulated Annealing, xii) Simulated Annealing, xiii) Stochastic Quantization, and xiv) Sensitivity Optimization for Delay Systems.

58287 **(AD-A—195460/1/XAB) Parallel Lisp simulator.** Weening, J.S. (Stanford Univ., CA (USA). Dept. of Computer Science). May 1988. 30p. (STAN-CS—88-1206). NTIS, PC A03/MF A01.

CSIM is a simulator for parallel Lisp, based on a continuation passing interpreter. It models a shared-memory multiprocessor executing programs written in Common Lisp, extended with several primitives for creating and controlling processes. This paper describes the structure of the simulator, measures its performance, and gives an example of its use with a parallel Lisp program.

58288 **(AD-A—195502/0/XAB) Concurrent algorithms for numerical computation on hypercube computer. Final report, 1 October 1986-30 September 1987.** Schnabel, R. (Colorado Univ., Boulder (USA). Dept. of Computer Science). 22 Feb 1988. 3p. NTIS, PC A02/MF A01.

The purpose of this grant was to purchase a hypercube computer to support DoD-sponsored research, and other research, in parallel numerical computation. The plans that were outlined in the proposal were followed very closely. A 32-node Intel iPSC-D5 hypercube computer with the funds from this grant, and have used the matching University contribution to support the maintenance of this computer. This computer has been used, over the past year, for research in parallel numerical computation in areas including global optimization, VLSI design, large sparse systems of linear equations, and eigenvalue problems, as well as for research in the languages for parallel computation and in the debugging and measurement of parallel programs.

58289 **(AD-A—195518/6/XAB) Performance of scientific software.** Houstis, E.N.; Rice, J.R.; Christara, C.C.; Vavalis, E.A. (Purdue Univ., Lafayette, IN (USA). Dept. of Computer Science). 1988. 34p. NTIS, PC A03/MF A01.

Pub. in Mathematical Aspects of Scientific Software, Vol. 14, CH. 6, 123-155(1988).

The authors review performance methodologies used for the evaluation of scientific software in von Neumann architectures. A prototype evaluation facility for second-order elliptic partial differential equation (PDE) solvers is described, which realizes the main objectives of these methodologies. Finally, the results of an evaluation study for a new class of spline collocation solvers for elliptic PDEs are presented.

58290 (ANL—88-10) Searching for fixed point combinators by using automated theorem proving: A preliminary report. Wos, L.; McCune, W. (Argonne National Lab., IL (USA)). Sep 1988. Contract W-31109-ENG-38. 241p. NTIS, PC A11/MF A01. Order Number DE89001324/JAW.

In this report, we establish that the use of an automated theorem- proving program to study deep questions from mathematics and logic is indeed an excellent move. Among such problems, we focus mainly on that concerning the construction of fixed point combinators---a problem considered by logicians to be significant and difficult to solve, and often computationally intensive and arduous. To be a fixed point combinator, Θ must satisfy the equation Θx = x(Θx) for all combinators x. The specific questions on which we focus most heavily ask, for each chosen set of combinators, whether a fixed point combinator can be constructed from the members of that set. For answering questions of this type, we present a new, sound, and efficient method, called the kernel method, which can be applied quite easily by hand and very easily by an automated theorem-proving program. For the application of the kernel method by a theorem-proving program, we illustrate the vital role that is played by both paramodulation and demodulation---two of the powerful features frequently offered by an automated theorem-proving program for treating equality as if it is "understood." We also state a conjecture that, if proved, establishes the completeness of the kernel method. From what we can ascertain, this method---which relies on the introduced concepts of kernel and superkernel---offers the first systematic approach for searching for fixed point combinators. We successfully apply the new kernel method to various sets of combinators and, for the set consisting of the combinators B and W, construct an infinite set of fixed point combinators such that no two of the combinators are equal even in the presence of extensionality---a law that asserts that two combinators are equal if they behave the same. 18 refs.

58291 (ANL—88-38) LAPACK Working Note No. 5: Provisional contents. Bischof, C.; Demmel, J.; Dongarra, J.; Du Croz, J.; Greenbaum, A.; Hammarling, S.; Sorensen, D. (Argonne National Lab., IL (USA)). Sep 1988. Contract W-31109-ENG-38. 53p. NTIS, PC A04/MF A01. Order Number DE89001579/JAW.

This note outlines the proposed computational routines in LAPACK. It describes a naming scheme for the routines, enumerates the individual routines, includes notes on the choice of algorithms and discusses aspects of software design. The contents of this note are provisional and may be modified in the light of comment and experience. 25 refs.

58292 (ANL/MCS-TM—115) Computation of cusp singularities for operator equations and their discretizations. Griewank, A.; Reddien, G.W. (Argonne National Lab., IL (USA). Mathematics and Computer Science Div.). Aug 1988. Contract W-31109-ENG-38. 19p. NTIS, PC A03/MF A01. Order Number DE89000695/JAW.

We discuss the direct calculation of cusp singularities as solutions of a minimally augmented defining system, which is nonsingular under the canonical cusp conditions. The underlying operator equation may have any finite Fredholm index, and bounds on the discretization error are derived for the case of projection methods. 22 refs., 3 figs.

58293 (ANL/MCS-TM—125) ELEFUNT test results under FORTRAN-PLUS on the active memory technology DAP 510-8. Cody, W.J. (Argonne National Lab., IL (USA)). Sep 1988. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01. Order Number DE88017264/JAW.

This report discusses testing of the elementary function library supplied with FORTRAN-PLUS on the Active Memory Technology DAP 510-8 computer in the Mathematics and Computer Science Division's Advanced Computing Research Facility. Performance tests were conducted using the ELEFUNT suite of programs from the book Software Manual for the Elementary Functions by Cody and Waite. The report includes a brief description of the computing environment, a short analysis of DAP arithmetic, and a summary and analysis of the test results. 5 refs., 6 tabs

58294 (ANL/TM—455-Rev.1) Using the central VAX 8700 computer at ANL [Argonne National Laboratory]. Lark, D.T.; Caruthers, C.M.; Bragg, R.W. (eds.). (Argonne National Lab., IL (USA)). Sep 1988. Contract W-31109-ENG-38. 109p. NTIS, PC A06/MF A01. Order Number DE89001168/JAW.

This paper is a manual for using the VAX 8700 computer at ANL. The chapters include: The central VAX cluster: What it is and how it works; Training and other available assistance; Getting started with the VAX 8700 computer and VAX/VMS; Using the VAX/VMS file system; Developing programs in VMS; Using batch; Using available software; and Using graphics in VAX/VMS. (LSP)

58295 (BNL—41530) VM-CMS tutorial. (Brookhaven National Lab., Upton, NY (USA)). Aug 1988. Contract AC02-76CH00016. 196p. NTIS, PC A09/MF A01. Order Number DE89000258/JAW.

This report describes the use of a full screen editor on IBM mainframes. Detailed information is given. (LSP)

58296 (CONF-880117—6) Large-grain pipelining on hypercube multiprocessors. King, Chung-Ta; Ni, Lionel M. (Argonne National Lab., IL (USA); Michigan State Univ., East Lansing (USA). Dept. of Computer Science). 1988. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01. Order Number DE89000523/JAW.

From 3. conference on hypercube concurrent computers and applications; Pasadena, CA, USA (19 Jan 1988).

A new paradigm, called large-grain pipelining, for developing efficient parallel algorithms on distributed-memory multiprocessors, e.g., hypercube machines, is introduced. Large-grain pipelining attempts to maximize the degree of overlapping and minimize the effect of communication overhead in a multiprocessor system through macro-pipelining between the nodes. Algorithms developed through large-grain pipelining to perform matrix multiplication are presented. To model the pipelined computations, an analytic model is introduced, which takes into account both underlying architecture and algorithm behavior. Through the analytical model, important design parameters, such as data partition sizes, can be determined. Experiments were conducted on a 64-node NCUBE multiprocessor. The measured results match closely with the analyzed results, which establishes the analytic model as an integral part of algorithm design. Comparison with an algorithm which does not use large-grain pipelining also shows that large-grain pipelining is an efficient scheme for achieving a greater parallelism. 14 refs., 12 figs.

58297 (CONF-880569—4) High level tools for GKS graphics. Worlton, T.G. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 8p. NTIS, PC A02/MF A01. Order Number DE89000587/JAW.

From DECUS spring symposium; Cincinnati, OH, USA (16 May 1988).

GKS graphics software provides a device independent method of producing graphics on a number of different devices, but it is a rather low level package which is difficult to use. The GPLOT Fortran library of graphics tools discussed here can be used to simplify the creation of scientific graphics with VAX GKS[GPL]. GPLOT contains routines for drawing and labelling of axes for linear, log, and log-log plots. It supports the drawing of data curves with or without markers and/or error bars on the data points. It provides routines for producing a legend which automatically keeps track of the line type, color, and marker type used in producing each of the curves on a plot. There are also routines for producing contour plots, bar graphs and for drawing vectors with various types of arrow heads. GPLOT allows setting the text font by font name and attributes. It also allows the definition of switch characters to switch fonts or do subscripts and superscripts using instructions embedded in the string. GPLOT supports the GKS feature of multiple active workstations which allows creation of hardcopy plots while plotting to the screen. GPLOT supports creation of GKS metafiles and includes a program for interpreting and plotting GKS metafiles. It also supports graphics locator input with conversion of coordinates to user units if desired. To simplify user

interaction during input, there are routines for switching between VT220 mode and graphics mode. A number of examples are presented. 12 refs., 6 figs.

58298 **(CONF-881058—2) Human factors in the Naval Air Systems Command: Computer based training.** Seamster, T.L.; Snyder, C.E.; Terranova, M.; Walker W.J.; Jones, D.T. (Carlow Associates, Inc., Fairfax, VA (USA); Oak Ridge National Lab., TN (USA); Naval Air Systems Command, Washington, DC (USA)). [1988]. Contract AC05-84OR21400. 6p. (CONF-881058—2). NTIS, PC A02/MF A01. Order Number DE88015301/JAW.

From Human Factors Society annual meeting; Anaheim, CA, USA (24 Oct 1988).

Military standards applied to the private sector contracts have a substantial effect on the quality of Computer Based Training (CBT) systems procured for the Naval Air Systems Command. This study evaluated standards regulating the following areas in CBT development and procurement: interactive training systems, cognitive task analysis, and CBT hardware. The objective was to develop some high-level recommendations for evolving standards that will govern the next generation of CBT systems. One of the key recommendations is that there be an integration of the instructional systems development, the human factors engineering, and the software development standards. Recommendations were also made for task analysis and CBT hardware standards. (9 refs., 3 figs.)

58299 **(CONF-881116—2) Design of an obstacle avoidance system for AIMS.** Reister, D.B.; Noakes, M.W. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01. Order Number DE88016783/JAW.

From Advances in intelligent robotics systems; Cambridge, MA, USA (6 Nov 1988).

The Advanced Integrated Maintenance System (AIMS) is a remote maintenance system that uses a dual-arm teleoperator to control the Advanced Servomanipulator (ASM). Although, the ASM was designed for nuclear fuel reprocessing, it can provide a testbed for space telerobotics (space servicing and assembley). The objective of this project is to design and implement a generalized capability for automatic path-planning and obstacle avoidance during motion of the manipulator transporter (overhead crane and main manipulator shaft) from one work location in the hotcell to another. The work is to be accomplished in two phases. In the first phase, the transporter will move in a known world. In the second phase, sensor data will be used to update and verify the world model and the system will have the capability to avoid unexpected obstacles. This paper describes the design and initial development of a system for phase one. 3 refs., 2 figs.

58300 **(CONF-881116—3) Man-robot symbiosis: a framework for cooperative intelligence and control.** Parker, L.E.; Pin, F.G. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01. Order Number DE89000430/JAW.

From Advances in intelligent robotics systems; Cambridge, MA, USA (6 Nov 1988).

The man-robot symbiosis concept has the fundamental objective of bridging the gap between fully human-controlled and fully autonomous systems to achieve true man-robot cooperative control and intelligence. Such a system would allow improved speed, accuracy, and efficiency of task execution, while retaining the man in the loop for innovative reasoning and decision-making. The symbiont would have capabilities for supervised and unsupervised learning, allowing an increase of expertise in a wide task domain. This paper describes a robotic system architecture facilitating the symbiotic integration of teleoperative and automated modes of task execution. The architecture reflects a unique blend of many disciplines of artificial intelligence into a working system, including job or monitoring, and machine learning. These disciplines are embodied in five major components of the symbiotic framework: the Job Planner, the Dynamic Task Allocator, the Presenter/Interpreter, the Automated Monitor, and the Learning System. 12 refs., 3 figs.

58301 **(CONF-8805200—1) Parallel sparse Gaussian elimination with partial pivoting.** George, A.; Ng, E. (Oak Ridge National Lab., TN (USA); Waterloo Univ., Ontario (Canada). Dept. of Computer Science). 1988. Contract AC05-84OR21400. 22p. NTIS, PC A03/MF A01. Order Number DE89000654/JAW.

From Workshop on supercomputers and large-scale optimization: algorithms, software, and applications; Minneapolis, MN, USA (16 May 1988).

In this article we consider the factorization of a sparse nonsymmetric matrix using Gaussian elimination with partial pivoting on a multiprocessor having a globally-shared memory. The parallel algorithm makes use of a static data structure developed by George, Liu and Ng. Some numerical experiments on a Sequent Balance 8000 are presented to demonstrate the efficiency of the parallel implementation. 10 figs., 6 tabs.

58302 **(CONF-8807116—1) Pipelined data parallel algorithms: Concept and modeling.** King, Chung-Ta; Chou, Wen-Hwa; Ni, Lionel M. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 11p. NTIS, PC A03/MF A01. Order Number DE89000536/JAW.

From International conference on supercomputing; Saint-Malo, France (4 Jul 1988).

A new style of efficient parallel algorithms on distributed-memory multiprocessors is introduced, which exploits parallelism through pipelined parallel computation, or {ital large-grain pipelining}. By using macro-pipelining between nodes in the system, large-grain pipelining regulates the flows of data in the multiprocessor so that the degree of overlapping can be maximized and the effect of communication overhead can be minimized. To model pipelined parallel computations, an analytic model is presented, which takes into account both underlying architecture and algorithm behavior. The resultant model is accurate enough to not only predict the performance of a given algorithm, but also assist in algorithm designs for determining optimal design parameters such as the granularity. Results from experiments performed on a 64-node NCUBE multiprocessor match closely to the predicted performance. A systematic procedure for designing pipelined data parallel algorithms from nested loop programs is described. The impact of the second generation distributed-memory multiprocessors on the pipelined parallel computations is also discussed. 5 refs., 11 figs., 1 tab.

58303 **(CONF-8808140—1) On enhancing hypercube multiprocessors.** Esfahanian, A.H.; Ni, L.M.; Sagan, B.E. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 5p. NTIS, PC A02. Order Number DE89000534/JAW.

From International conference on parallel processing; St. Charles, IL, USA (15 Aug 1988).

We show that by exchanging any two independent edges in any shortest cycle of the n-cube (n≧3), its diameter decreases by one unit. This leads us to define a new class of n-regular graphs, denoted TQ/sub n/, with 2/sup n/ vertices and diameter n-1, which has the (n-1)-cube as subgraph. Other properties of TQ/sub n/ such as connectivity and the lengths of the disjoints paths are also investigated. Moreover, we show that the complete binary tree on 2/sup n/-1 vertices, which is not a subgraph of the n-cube, is a subgraph of TQ/sub n/. Finally, we discuss how these results can be used to enhance existing hypercube multiprocessors. 17 refs., 4 figs.

58304 **(CONF-8809151—1) Graphics tools for developing high-performance algorithms.** Brewer, O.; Dongarra, J.; Levine, D.; Sorensen, D. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 11p. NTIS, PC A03/MF A01. Order Number DE89000526/JAW.

From International meeting on parallel computing methods, algorithms, algorithms, applications; Verona, Italy (28 Sep 1988).

This paper discusses two stools that aid in the development of parallel algorithms for high-performance computers. We describe the SCHEDULE package which provides an environment for developing and analyzing new parallel algorithms in Fortran that require sophisticated synchronization at a large-grain level. This package provides portability of a user's code and also has a graphics postprocessor for performance analysis and debugging. We also

discuss a graphics tool useful for studying memory access patterns of algorithms.

58305 **(CONF-8810122—2) Selecting AI tools using a hierarchical decision process.** Emrich, M.L.; Bhasin, J. (Oak Ridge National Lab., TN (USA)). Jul 1988. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01. Order Number DE88015548/JAW.

From 51. annual meeting of the American Society for Information Science; Atlanta, GA, USA (23 Oct 1988).

When choosing from among several alternatives, the consideration of multiple criteria is usually required. One method for evaluating alternatives is the Analytic Hierarchy Process (AHP). A pairwise comparison of criteria is performed to establish the criteria's impact on the task. Based on the criteria, a pairwise comparison of alternatives is made. Using these comparisons, AHP assigns weights. By performing eigenvalue calculations on the weights, AHP determines a ranking for each candidate. On the basis of thirteen criteria, a panel of experts ranked seven AI tools. A program was developed to use AHP methods for tool selection. In an on-screen pairwise comparison, the user indicates how important each criteria is for a given problem. The program combines user inputs and expert judgments to determine the appropriate tool. 14 refs., 4 figs., 2 tabs.

58306 **(DOE/ER—0386) Summaries of the FY 1988 applied mathematical sciences research program.** (USDOE Office of Energy Research, Washington, DC. Scientific Computing Staff). Sep 1988. 71p. NTIS, PC A04/MF A01. Order Number DE89000242/JAW.

This report is a compilation of summaries of the individual research projects that constitute the Applied Mathematical Sciences research subprogram managed by the Director, Scientific Computing Staff, Office of the Director of Energy Research, Department of Energy. The general topics of the research projects are: Analytical and numerical methods; Information analysis techniques; advanced computing concepts, Energy science advanced computation; and capital equipment.

58307 **(DOE/ER/25026—T2) Computational methods and software for differential equations and their applications: Annual report.** Gear, C.W.; Skeel, R.D. (Illinois Univ., Urbana (USA). Dept. of Computer Science). Jul 1988. Contract FG02-87ER25026. 10p. NTIS, PC A02/MF A01. Order Number DE89000025/JAW.

This paper discusses the following topics: parallel and waveform methods for ODEs, differential-algebraic equations, and multilevel methods. 14 refs.

58308 **(DP-MS—88-174) Robotics development programs overview Savannah River Plant.** Heckendorn, F.M.; Veenema, P. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1988. Contract AC09-76SR00001. 28p. (CONF-8810175—1). NTIS, PC A03. Order Number DE89001235/JAW.

From JOWOG 39-manufacturing technology - SUBWOG F-robotics conference; Santa Fe, NM, USA (4 Oct 1988).

The Savannah River Laboratory (SRL) continues to provide support to the Savannah River Plant (SRP) in many areas to Robotics and Vision. An overview of the current and near term future developments are presented. The driving forces for Robotics and Remote vision systems at SRP include both the classic reasons for industrial robotics installation (i.e., repetitive and undesirable jobs) and those reasons related to radioactive environments. Protection of personnel from both radiation and radioactive contamination benefit greatly from robotic and telerobotics. In addition the quality of the information available from a hazardous environment can be improved by the ability to visually linger and remotely sense.

58309 **(EFI-TR—3426) Computer program ENMDAT. Input of data to the single-storage model VANSIM.** Green, T.G.; Reitan, R. (Elektrisitetsforsyningens Forskningsinstitutt, Trondheim (Norway)). Jun 1987. 80p. (In Norwegian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88754853/JAW.

The computer program ENMDAT, presented in this report, is a man- machine directed data-input program for the single-storage model VANSIM. The report explains the significance of the entry data for the model VANSIM. The entry data are directed towards the users for the run of the model VANSIM, the draw-off control model SIMTAP or SAMKJOERINGSMODELLEN (grid-system operation model). 5 drawings, 4 tables.

58310 **(EGG-M—88284) The use of think aloud verbal protocols for the identificaton of mental models.** Blackman, H.S. (EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC07-76ID01570. 3p. (CONF-881058—3). NTIS, PC A02/MF A01. Order Number DE88015180/JAW.

From Human Factors Society annual meeting; Anaheim, CA, USA (24 Oct 1988).

Results regarding the use of protocol analysis techniques are presented to show how they may improve the models identified through other knowledge engineering techniques and how these models may then be used to improve performance through training. Data from two experiments are presented and discussed.

58311 **(FEI—1847) PRECON program complex. Description of application. Instructions for programmers.** Baranov, O.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1987. 30p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88703495/JAW.

The PRECON program complex realizing a series of improvements for the ARAMAKO-CI standard system for preparation of 26 group constants, used for computation of nuclear reactors and radiation shields, is described. Calculation of the resonance self-shielding of nuclide cross sections being part of a physical zone may be carried out for spectrum of an infinite medium with any specified composition. Possibilities for a more correct account of boundary resonance effects and those of neutron leakage from the core in the B/sup 2/ approximation at the stage of constant preparation are introduced. The description of application and instructions for programmers with a brief delivery of constant preparation algorithm are presented. An example of test job formulation is presented. 4 refs.; 2 figs.; 1 tab.

58312 **(FNAL/C—88/97) High performance parallel computers for science: New developments at the Fermilab advanced computer program.** Nash, T.; Areti, H.; Atac, R.; Biel, J.; Cook, A.; Deppe, J.; Edel, M.; Fischler, M.; Gaines, I.; Hance, R. (Fermi National Accelerator Lab., Batavia, IL (USA)). Aug 1988. Contract AC02-76CH03000. 18p. (CONF-8804125—2). NTIS, PC A03. Order Number DE88016465/JAW.

From Computational atomic and nuclear physics at one gigaflop conference; Oak Ridge, TN, USA (14 Apr 1988).

Fermilab's Advanced Computer Program (ACP) has been developing highly cost effective, yet practical, parallel computers for high energy physics since 1984. The ACP's latest developments are proceeding in two directions. A Second Generation ACP Multiprocessor System for experiments will include $3500 RISC processors each with performance over 15 VAX MIPS. To support such high performance, the new system allows parallel I/O, parallel interprocess communication, and parallel host processes. The ACP Multi-Array Processor, has been developed for theoretical physics. Each $4000 node is a FORTRAN or C programmable pipelined 20 MFlops (peak), 10 MByte single board computer. These are plugged into a 16 port crossbar switch crate which handles both inter and intra crate communication. The crates are connected in a hypercube. Site oriented applications like lattice gauge theory are supported by system software called CANOPY, which makes the hardware virtually transparent to users. A 256 node, 5 GFlop, system is under construction. 10 refs., 7 figs.

58313 **(JINR-E—11-88-233) Computataion of conditional wiener integrals by the composite approximation formulae with weight.** Lobanov, Y.Y.; Shakhbagyan, R.R.; Sidorova, O.V.; Zhidkov, E.P. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1988. 14p. (CONF-8807112—1). NTIS (US Sales Only), PC A03. Order Number DE88015961/JAW.

From International congress on computational and applied mathematics; Leuven, Belgium (1 Jul 1988).

New approximation formulae with weight for the functional integrals with conditional Wiener measure are derived. The formulae are exact on a class of polynomial functionals of a given degree. The convergence of approximations to the exact value of integral is proved, the estimate of the remainder is obtained. The results are illustrated with numerical examples. The advantages of the formulae over lattice Monte Carlo method are demonstrated in computation of some quantities in Euclidean quantum mechanics. 16 refs., 4 figs., 3 tabs.

58314 **(LA—11425-T) Assignment of points to three-dimensional trajectories.** Sorsby, C.R. (Los Alamos National Lab., NM (USA)). Oct 1988. Contract W-7405-ENG-36. 121p. NTIS, PC A06/MF A01. Order Number DE89001015/JAW.

The subject of this thesis is the assignment of 3-D points to trajectories in the context of computer vision and image understanding. Successive frames of points, 3-D range-images, are assigned to trajectories according to smoothness of motion criteria. No assumptions are made about rigidity of objects. The 3-D range images used may originate from any range finder such as stereo vision, a time-of-flight range finder, etc. These range images are assumed to be arriving in a variety of applications such as autonomous vehicle navigation or intrusion detection in addition to its application in scene analysis. Greedy exchange algorithms are examined and versions that accept continuously arriving sets of points are implemented in the C programming language. The algorithm implementations are embedded in a software test-frame which simulates the continuous arrival of 3-D range-images. The simulated range images are generated in such a way as to assign points to trajectories at random. Then the algorithms are used to reassign the points to the correct trajectories, thus testing the efficacy of the algorithms. A parallel implementation is attempted on a 12 processor Encore computer and some possibilities for a processor array implementation, such as a systolic array or a wavefront array processor, are described. 17 refs., 20 figs.

58315 **(LA-UR—88-1423) Experiences with global optimization techniques in massively parallel processing environments.** Hall, J.H.; Hiromoto, R. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 10p. (CONF-881112—3). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88009109/JAW.

From Supercomputing conference; Orlando, FL, USA (14 Nov 1988).

The modeling of many physically relevant processes involves the location of global extrema, which are often surrounded by numerous local extrema. The effort involved in locating these extrema grows rapidly with increasing dimensionality of the problems being investigated. A method of analysis for algorithms from the perspective of a parallel processing environment is developed and applied to the family of Monte Carlo global optimization schemes. A new highly parallel Monte Carlo algorithm is presented. Chaotic iteration schemes resulting in nondeterministic algorithms are discussed, and an analysis of the optimal conditions for their application to this class of problems is presented. 11 refs., 4 figs.

58316 **(LA-UR—88-2572) Selecting an authoring system 1988: How the vendors make it more difficult.** Trainor, M.S.; Schultejann, P.A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 8p. (CONF-881173—1). NTIS, PC A02/MF A01. Order Number DE88015696/JAW.

From 30. international conference of the Association for the Development of Computer-Based Instructional Systems (ADCIS); Philadelphia, PA, USA (7 Nov 1988).

The information and demonstration packages provided by vendors of authoring systems are not adequate to make a thorough evaluation of the product. Usually, data critical to the evaluation process is absent in favor of detailed descriptions of features of the system. The difficulties we encountered in evaluating authoring systems prompted several recommendations for vendors to include in their packages. These recommendations include allowing the prospective customer to actually use the system, providing information on instructional strategies and sequences that can be achieved with the system, and expanding the information provided on computer-managed instruction (CMI) capabilities and applications. The paper does not include any reference to specific vendors or systems, for the purpose is to increase awareness of a specific problem in the field. 12 refs.

58317 **(LA-UR—88-2678) Mass storage system reference model system management.** Collins, B.; McLarty, T. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 9p. (CONF-8810162—1). NTIS, PC A02/MF A01. Order Number DE88016325/JAW.

From 9. IEEE symposium on mass storage; Monterey, CA, USA (31 Oct 1988).

System Management is the collection of functions that are primarily concerned with the control, performance and utilization of the Mass Storage System defined by the Mass Storage System Reference Model. These functions are often very site-dependent, involve human decision making, and span multiple "severs" of the Mass Storage System. The functions may be implemented as standalone programs, may be integrated with the other Mass Storage System software, or may just be policy. 4 refs.

58318 **(LA-UR—88-2781) How EXCELERATOR changed my job.** Weir, D. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 10p. (CONF-8810158—1). NTIS, PC A02/MF A01. Order Number DE88016162/JAW.

From 4. annual index technology user conference; St. Louis, MO, USA (10 Oct 1988).

I started using a Computer-Aided Software Engineering (CASE) analysis/design tool two years ago in the Administrative Data Processing Division (ADP) and have observed that the way I approach my job has changed. The end product is the same, but the product is derived differently. The ability to change what is done gives freedom to experiment and iterate. This freedom has changed some steps and resequenced others in arriving at a structured specification for a new system. Additionally, the analysis capability of the tools allow the performance of work that was often disregarded because it was either too tedious or overwhelming. This presentation will address the changes observed in the process of analysis and design using CASE. 2 figs.

58319 **(ORNL/TM—10118) Building distribution system design criteria for the ORNL/interplant broadband network.** Clayton, D.A.; Jansen, J.M. Jr.; Hayes, R.W.; Hayes, T.W. (Oak Ridge National Lab., TN (USA)). Dec 1987. Contract AC05-84OR21400. 22p. NTIS, PC A03. Order Number DE89001142/JAW.

This document sets forth the guidelines necessary for the design and implementation of building distributions and trunk extensions for the ORNL/interplant broadband network while maintaining the standards of quality required for reliable system performance. This document addresses the various aspects of hardware selection and design criteria as well as testing and documentation. These criteria have been used since February 1986 to extend the network to a dozen new buildings. 4 figs., 1 tab.

58320 **(ORNL/TM—10866) Parallel sparse Gaussian elimination with partial pivoting.** George, A.; Ng, E. (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 33p. NTIS, PC A03/MF A01. Order Number DE89001170/JAW.

In this article we consider the factorization of a sparse nonsymmetric matrix using Gaussian elimination with partial pivoting on a multiprocessor having a globally-shared memory. The parallel algorithm makes use of a static data structure developed by George, Liu and Ng. Some numerical experiments on a Sequent Balance 8000 are presented to demonstrate the efficiency of the parallel implementation. 28 refs., 10 figs., 6 tabs.

58321 **(ORNL/TM—10868) Generation of an ordered simple random sample without replacement using one random number.** Etheridge, Y.H.; Wright, T. (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 12p. NTIS, PC A03/MF A01. Order Number DE89001341/JAW.

Nigam and Gupta presented by examples a method for the identification of the n units to be included in a simple random sample (SRS) for selection from a finite universe of N(> n) distinct and indentifiable units. The method calls for the generation of only one random number to select a SRS of n units without having to list all binomial coefficients, possible samples - practically all other methods require the generation of between n and N random numbers. Wright has given a slightly faster and generalized algorithm and demonstrated that the generalized algorithm to generate a SRS has a natural relation with Pascal's Triangle. The slight improvement in speed is a direct result of the establishment of a link with Pascal's Triangle. Below is a program that executes the generalized algorithm as described by Wright. 5 refs.

58322 **(ORNL/TM—10929) A new algorithm for linear programming that is easy to implement: Application to the transportation problem.** Culioli, J.C.; Protopopescu, V. (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 36p. (CESAR—88/52). NTIS, PC A03/MF A01. Order Number DE89001330/JAW.

We propose a new algorithm for linear-programming and apply it to solve some transportation problems. We prove the convergence of the algorithm under reasonable sufficient conditions. The main motivation of this new lincar-programming solver is its extreme simplicity and its parallel structure which allows for straightforward implementations on personal computers as well as on more sophisticated machines. We give in the Appendix a version of the algorithm programmed in C in less than 30 lines. We also comment in the Appendix on the relationship of our algorithm with some models of neural networks. 14 refs., 10 figs.

58323 **(PB—88-867643/XAB) Parallel processors. October 1986-August 1987 (Citations from the Compendex data base). Report for October 1986-August 1987.** (National Technical Information Service, Springfield, VA (USA)). Aug 1988. 182p. NTIS PC N01/MF N01.

This bibliography contains citations concerning research on the design, development, and application of parallel processors. Studies include the development of numerical techniques for parallel processing, scheduling parallel processors, and parallel processing of various types of scientific data. The development of algorithms and computer programs is presented. Specific studies on Illiac computers are considered. (This updated bibliography contains 445 citations, none of which are new entries to the previous edition.)

58324 **(PB—88-867650/XAB) Parallel processors. September 1987-August 1988 (Citations from the Compendex data base). Report for September 1987-August 1988.** (National Technical Information Service, Springfield, VA (USA)). Aug 1988. 72p. NTIS PC N01/MF N01.

Supersedes PB—87-866661.

This bibliography contains citations concerning research on the design, development, and application of parallel processors. Studies include the development of numerical techniques for parallel processing, scheduling parallel processors, and parallel processing of various types of scientific data. The development of algorithms and computer programs is presented. Specific studies on Illiac computers are considered. (This updated bibliography contains 138 citations, all of which are new entries to the previous edition.)

58325 **(SAND—87-2997) EXODUS: A finite element file format for pre- and postprocessing.** Mills-Curran, W.C.; Gilkey, A.P.; Flanagan, D.P. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1988. Contract AC04-76DP00789. 41p. NTIS, PC A03/MF A01. Order Number DE89001054/JAW.

The EXODUS format defines a binary file which is used for finite element analysis pre- and postprocessing. It includes data to define the finite element mesh and label both boundary condition and load application points. EXODUS accommodates multiple element types and is sufficiently general format for analysis results. A benefit of combining the mesh definition data and the results data in the same file is that the user is assured that the results data are consistent with the model. EXODUS is currently in use by the entire range of Department 1520 codes (including preprocessors, translators, linear and nonlinear analyses, and postprocessors) and is finding applications in codes outside Department 1520. 2 refs., 2 figs., 1 tab.

58326 **(SAND—88-1170C) OSMOND: A gridless, all-angle PC board routing system.** Chavez, J.C. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 12p. (CONF-881117—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88008793/JAW.

From International conference on computer-aided design; Santa Clara, CA, USA (7 Nov 1988).

This paper describes a computer-aided design system for routing printed circuit boards. This system unlike most others, permits all-angle routing of circuit paths and is completely gridless. It combines the flexibility of an interactive router with powerful features found on automatic routers. The system also easily accommodates various pad sizes and shapes and contains other features which facilitate the placement and routing of high-quality printed circuit boards. The system has been used at our facility to produce numerous multilayer printed circuit boards (including surface-mount boards) for both ground and space-flight applications. 5 refs., 11 figs.

58327 **(SAND—88-1417C) GREEDI---The computerization of the DOE/DOD environmental data bank.** Adams, C.R.; Kephart, E.M. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 13p. (CONF-881076—3). NTIS, PC A03/MF A01. Order Number DE88014965/JAW.

From 59. shock and vibration symposium; Albuquerque, NM, USA (18 Oct 1988).

One of the major responsibilities of Sandia National Laboratories is to develop shock and vibration specifications for system mechanical, electrical, and pyrotechnic components. The data required to generate these specifications are collected from finite element analyses, from laboratory simulation experiments with hardware, and from environmental tests. The production of the component specifications requires the analysis, comparison, and continual updating of these data. Sandia National Laboratories has also maintained the DOE/DOD Environmental Data Bank for over 25 years to assist in its shock and vibration efforts as well as to maintain data for several other types of environments. A means of facilitating shared access to engineering analysis data and providing an integrated environment to perform shock and vibration data analysis tasks was required. An interactive computer code and database system named GREEDI (a Graphical Resource for an Engineering Environmental Database Implementation) was developed and implemented. This transformed the DOE/DOD Environmental Data Bank from a card index system into an easily accessed computerized engineering database tool that can manage data in digitized form. GREEDI was created by interconnecting the SPEEDI (Sandia Partitioned Engineering Environmental Database Implementation) code, and the GRAFAID code, an interactive X-Y data analysis tool. An overview of the GREEDI software system is presented. 10 refs.

58328 **(SAND—88-2085C) Automated regression testing of CAD/CAM systems.** Burd, W.C. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 12p. (CONF-8810177—1). NTIS, PC A03/MF A01. Order Number DE88016743/JAW.

From 4. meeting of SUBWOG 39E on computer-integrated manufacturing (CIM); Cardiff, UK (3 Oct 1988).

A description of automated software quality assurance techniques is presented. These techniques detect regression in the "unchanged" functions of CAD/CAM software during new updates from a vendor. Interfaces for the test mechanisms, methods for automatic results analysis, test management requirements, and experience gained from a prototype automatic regression test system are included. 7 figs.

58329 **(SAND—88-2088C) The NC [numerically controlled] assistant: Interfacing knowledge based manufacturing tools to CAD/CAM systems.** Burd, W.C. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 34p. (CONF-8610203—2). NTIS, PC A03/MF A01. Order Number DE88016742/JAW.

From CIM SUBWOG 39E meeting; Aldermaston, UK (6 Oct 1986).

A knowledge based computer program that assists programmers of numerically controlled (NC) machine tools is described. The program uses part features identified by the NC programmer and a set of expert system manufacturing rules to select cutting parameters and produce NC part programs. An expert system shell determines the NC sequence and the machining parameters. Several point-to-point NC functions are currently in production. A CAD/CAM system interface for milling and turning functions is also described. 2 refs., 24 figs.

58330 **(SAND—88-2211C) A comparison of software architectures for integrating voice I/O into existing alarm processing and display system editors.** Funkhouser, B.R.; Helgesen, S.E.; Moseley, M.R. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 6p. (CONF-8810124—1). NTIS, PC A02/MF A01. Order Number DE88014523/JAW.

From AVIOS '88: the voice I/O systems applications conference; San Francisco, CA, USA (4 Oct 1988).

We integrate Voice Command interfaces into the existing architectures of Editor tools developed to specify the configuration of a Site Independent Configurable Alarm Display System (SICADS). The complete SICADS software package consists of the editor tools to specify a new alarm display system, and the system generator to build the specified system, using the new specification entered through the editors and a library of reusable software modules designed to be data-driven.

58331 **(SAND—88-2482C) Uncertainty analyses and applications.** Pettit, R.B.; Thacher, P.D. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 10p. (CONF-881174—1). NTIS, PC A03/MF A01. Order Number DE88016477/JAW.

From Experimental mechanics in manufacturing and quality control; Indianapolis, IN, USA (6 Nov 1988).

In all structural testing, the question of data quality involves a knowledge of the uncertainties of the test and measurement system. This report summarizes basic aspects of performing an uncertainty analysis for defining data quality. After describing two uncertainty classifications, a detailed list of sources of uncertainties is given together with recommended procedures for combining uncertainties. Considerations regarding the uncertainty statement are also discussed. Finally, a conclusion is made on the importance of an uncertainty analysis.

58332 **(SAND—88-2657) Multi-sensory integration as a result of perception.** Stansfield, S.A. (Sandia National Labs., Albuquerque, NM (USA)). 13 Sep 1988. Contract AC04-76DP00789. 19p. (CONF-8810164—1). NTIS, PC A03/MF A01. Order Number DE88017343/JAW.

From NATO ARW on knowledge-based robot control; Tsonas, France (10 Oct 1988).

For the most part, research into multi-sensor data fusion has concentrated on two areas: sensing and sensor modeling, and the creation of some central, usually geometric, representation of the world. From our perspective, this approach is narrow and local. The perceptual system will in fact need to integrate sensed data in many different ways{endash}homogeneously, heterogeneously, supportively, and directly. Integration of sensory information takes place at several different levels and utilizes several different mechanisms. A first level of integration takes place as sensor primitives are extracted from the world and combined to form more complex features. As these features are identified, they may be used to invoke motor functions which extract other, related, features from the object being perceived. This use of one set of sensory inputs to guide the extraction of others may be thought of as the second level of integration carried out by the perceptual system. Finally, at the highest level, multiple, disparate sensory features are aggregated into a heterogeneous central representation of the object as a whole. How the information contained within this aggregrate is used by the system is a function of both the available information and the task at hand. Thus, at this level, integration may be thought of as a top-down, knowledge-driven process. This paper explores how this model of multi-sensory integration might be implemented and utilized within a robotic system equipped with visual and tactile sensors. 21. refs., 5 figs.

58333 **(SOL—88-11) The role of ceiling points in general integer linear programming.** Saltzman, R.M.; Hillier, F.S. (Stanford Univ., CA (USA). Systems Optimization Lab.). Aug 1988. 38p. NTIS, PC A03/MF A01. Order Number DE89000020/JAW.

This report examines the role played by several kinds of ceiling points in solving the pure, general integer linear programming problem (ILP). While no assumptions are made concerning the structure or signs of the data of the problem, it is assumed that the feasible region for (ILP) is non-empty and bounded. A ceiling point with respect to a single constraint may be thought of as an integer solution on or close to the boundary of the feasible region defined by the constraint. The definition of a ceiling point with respect to a single constraint is extended to take multiple constraints into consideration simultaneously, defining what is called a feasible ceiling point. It is shown that the set of all feasible ceiling points contains at least one optimal solution for (ILP). A related class of solutions called feasible 1-ceiling points is also characterized and shown to contain all optimal solutions for (ILP). Moreover, 1-ceiling points are computationally easier to identify than ordinary ceiling points and may be sought with respect to one constraint at a time. It is also demonstrated that solving (ILP) requires only enumerating feasible 1-ceiling points with respect to a subset of all functional constraints. 8 refs., 6 figs.

58334 **(UCID—21099) The PLUS family: A set of computer programs to evaluate analytical solutions of the diffusion equation and thermoelasticity.** Montan, D.N. (Lawrence Livermore National Lab., CA (USA)). Feb 1987. Contract W-7405-ENG-48. 101p. NTIS, PC A06/MF A01. Order Number DE89001283/JAW.

This report is intended to describe, document and provide instructions for the use of new versions of a set of computer programs commonly referred to as the PLUS family. These programs were originally designed to numerically evaluate simple analytical solutions of the diffusion equation. The new versions include linear thermo-elastic effects from thermal fields calculated by the diffusion equation. After the older versions of the PLUS family were documented a year ago, it was realized that the techniques employed in the programs were well suited to the addition of linear thermo-elastic phenomena. This has been implemented and this report describes the additions. 3 refs., 14 figs.

58335 **(UCID—21460) Nuclear Weapons Complex Department of Energy Data Exchange Format (DOEDEF): Documentation deliverables for Phase 2.0 functional objective, Model/View/Draw.** Christensen, M. (Lawrence Livermore National Lab., CA (USA)). Jun 1988. Contract W-7405-ENG-48. 38p. NTIS, PC A03/MF A01. Order Number DE89001469/JAW.

The current DOEDEF structures used to transfer electronic data are single coordinate system databases referred to as All-model and All-draw. These databases are not the working environment of all current CAD systems but have been defined and used because of previous CAD systems inability to work in a double coordinate system. With the current CAD systems ability to support the double coordinate system, the Model/View/Draw database has been suggested as the vehicle for transferring electronic data. The Model/View/Draw structure must support an accurate 3-D geometric model and allow a detailed drawing based on this model geometry. The initial transfer will be in a neutral Model/View/Draw format using the currently supported IGES 3.0 entities with the structure containing as much intelligence as possible. The receiving site will then use the required information to accurately reconstruct the drawing.

58336 **(UCID—21511) Elementary sources of concurrency in a standard quasi-Newton unconstrained nonlinear optimization algorithm.** Verrill, S.; Hickman, D. (Lawrence Livermore National Lab., CA (USA)). May 1988. Contract W-7405-ENG-48. 15p. NTIS, PC A03/MF A01. Order Number DE89000660/JAW.

Neglecting scaling and stopping features, a standard quasi-Newton unconstrained nonlinear optimization algorithm has three main aspects—the Newton step, modifications to this step to ensure global convergence, and a possible secant approximation to the Hessian. We will discuss these aspects and the concurrencies associated with them. Before going into details, however, we make the general observation that there are two main sources of concurrency in the algorithms under consideration—function evaluations and linear algebra. If the function to be minimized and its derivatives are expensive to evaluate, we can expect good speedups from concurrent evaluations. If, on the other hand, function evaluation costs are relatively low, and the number of parameters (over which we are minimizing) is large, the greatest speedups will be obtained via concurrent linear algebra routines. We provide a brief introduction to sources of concurrency that are available at a higher level of sophistication, and that are currently under study. 11 refs.

58337 **(UCRL—98990) A visual interface for generic message translation.** Blattner, M.M.; Kou, L.T.; Carlson, J.W.; Daniel, D.W. (Lawrence Livermore National Lab., CA (USA)). 21 Jun 1988. Contract W-7405-ENG-48. 22p. (CONF-8810152—1). NTIS, PC A03/MF A01. Order Number DE88013107/JAW.

From Institute for Electrical and Electronics Engineers workshop on visual languages; Pittsburgh, PA, USA (10 Oct 1988).

This paper is concerned with the translation of data structures we call messages. Messages are an example of a type of data structure encountered in generic data translation. Our objective is to provide a system that the nonprogrammer can use to specify the nature of translations from one type to another. For this reason we selected a visual interface that uses interaction techniques that do not require a knowledge of programming or command languages. The translator must accomplish two tasks: create a mapping between fields in different message types that specifies which fields have similar semantic content, and reformat or translate data specifications within those fields. The translations are accomplished with appropriate, but different, visual metaphors. 14 refs., 4 figs.

58338 **(UCRL—99396) A form features-centered architecture for product definition exchange.** Vickers, D.L.; Swanson, K.A. (Lawrence Livermore National Lab., CA (USA)). 10 Aug 1988. Contract W-7405-ENG-48. 16p. (CONF-8810121—3). NTIS, PC A03/MF A01. Order Number DE88016283/JAW.

From Autofact '88; Chicago, IL, USA (30 Oct 1988).

One hurdle faced in developing electronic product definition exchange is the creation of an architecture of "roadmap" that clearly shows the relationship of the various components. This paper describes an architecture developed round the premise that form features will play a key role in the communication process among design, analysis, manufacturing, and inspection in Computer Integrated Manufacturing systems of the future. The paper details the Form Features-Centered Architecture and lists some views on form features by the Product Definition Initiative within the Department of Energy. 6 refs., 9 figs.

58339 **(UCRL—99485) A multigrid method for S/sub N/ calculations in X--Y geometry.** Nowak, P.F.; Larsen, E.W.; Martin, W.R. (Lawrence Livermore National Lab., CA (USA)). Aug 1988. Contract W-7405-ENG-48. 8p. (CONF-880601—49). NTIS, PC A02/MF A01. Order Number DE89001504/JAW.

From American Nuclear Society annual meeting; San Diego, CA, USA (12 Jun 1988).

A multigrid method has been presented which has been successfully used to accelerate the convergence of the low-order calculation in a synthetic method. We should also mention that a multilevel. Fourier analysis (slab geometry), which provides spectral radii for the overall multigrid algorithm, has also been developed. Spectral radii from this analysis have shown excellent agreement with spectral radii estimates made from model problem results. These analysis results, as well as progress in developing more efficient relaxation schemes for higher order discretization schemes, will be presented at the meeting. 5 refs., 1 tab.

58340 **A random access memory immune to single event upset using a T-Resistor.** Ochoa, A. Jr. US Patent Application 6-113,695. 28 Oct 1987. 29p. Contract AC04-76DP00789. NTIS, PC A03/MF A01.

In a random access memory cell, a resistance "T" decoupling network in each leg of the cell reduces random errors caused by the interaction of energetic ions with the semiconductor material forming the cell. The cell comprises two parallel legs each containing a series pair of complementary MOS transistors having a common gate connected to the node between the transistors of the opposite leg. The decoupling network in each leg is formed by a series pair of resistors between the transistors together with a third resistor interconnecting the junction between the pair of resistors and the gate of the transistor pair forming the opposite leg of the cell. 4 figs.

58341 **Improved technique for one-way transformation of information.** Cooper, J.A. US Patent Application 6-048,433. 11 May 1987. 41p. Contract AC04-76DP00789. NTIS, PC A03/MF A01.

Method and apparatus are provided for one-way transformation of data according to multiplication and/or exponentiation modulo a prime number. An implementation of the invention permits the one way residue transformation, useful in encryption and similar applications, to be implemented by n-bit computers substantially with no increase in difficulty or complexity over a natural transformation thereby, using a modulus which is a power of two. 9 figs.

9903 Information Handling

REFER ALSO TO CITATION(S) 56026, 56123, 56124, 56310, 56390, 56590, 56850, 57143, 57183, 57241, 57443, 57910, 58205, 58206, 58229, 58232, 58283, 58284, 58286, 58319, 58327, 58331

58342 **(IAEA-TECDOC—457, pp 217-223) Recent joint developments in cross-section uncertainty analysis at Los Alamos and EIR.** Davidson, J.W.; Dudziak, D.J.; Muir, D.W.; Stepanek, J.; Higgs, C.E. (Los Alamos National Lab., NM (USA); Paul Scherrer Inst. (PSI), Wuerenlingen (Switzerland)). Jun 1988. NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704189/JAW. (CONF-861250—).

From IAEA advisory group meeting on nuclear data for fusion reactor technology; Dresden, German D.R. (1 Dec 1986).

Recent development and future plans for the SENSIBL code along with associated covariance data and cross section libraries are described. (author). 34 refs, 1 fig.

58343 **(ORNL/DSRD/TM—18) Users manual for the Research Notes System (Version 1.5).** Hartley, D.S. III. (Oak Ridge National Lab., TN (USA). Data Systems Research and Development Program). May 1988. Contract AC05-84OR21400. 207p. NTIS, PC A10/MF A01. Order Number DE89001391/JAW.

The purpose of the Research Notes System (RNS) is to help collect and organize information. The information the RNS manages consists of notes which are typed into the system, references to the source of the note, and subject classifications of the note. The RNS may be used to organize the reference material (books, reprints of papers, etc.) which researchers typically accumulate, or it may be used in a directed search for a project, or both. The Research Notes System is a set of dBASE III programs and relational databases which meets this need. The RNS provides ease of data entry through the use of relational databases to minimize redundant data entry. The information is organized by keying each note to one or more user-defined subjects. The RNS also provides several retrieval methods for use during intermediate research phases and in the final-article writing phase. The RNS provides an update function so that a Master RNS may be maintained with multiple users of RNS copies. This document details the procedures neces-

sary to use the RNS. Areas covered include benefits, input data dictionaries, and tips on using the RNS, as well as detailed operating instructions. The operating instructions describe each operating step and each option with complete illustrations of the screen prompts and displays. The installation section describes how to use the system on a hard disk (the recommended hardware for the system) and on floppy disks.

58344 **(QER—1987) Catalog of publications of the Ministry of Energy and Resources, 1987.** (Quebec Ministere de l'Energie et des Resources, Quebec (Canada)). 1987. 142p. (In French). (MICROLOG—88-03959). Quebec Ministere de l'energie et des ressources, Direction des Communications, 200, chemin Ste-Foy, 7e etage, Quebec, P.Q., Canada G1R 4X7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This catalog covers publications of the four sectors of activities of the Quebec Ministry of Energy and Resources: energy, mining and minerals, lands (including surveying, geodesy, cartography) and forests. Publications of general interest as well as specialized scientific and technical documents are included.

58345 **(SAND—88-1429C) DOE/DOD Environmental Data Bank.** Davidson, C.A. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 6p. (CONF-881076—5). NTIS, PC A02/MF A01. Order Number DE88015262/JAW.

From 59. shock and vibration symposium; Albuquerque, NM, USA (18 Oct 1988).

The purpose of this paper is to describe an engineering analysis support activity which involves the collection, analysis, storage, and retrieval of technical environmental information. This information is at the disposal of system and component analysts for use in formulating initial conditions, forcing functions and performance requirements for numerous hardware application evaluations. This paper will describe the Engineering Environmental Data Bank system which provides this information service to many Sandia Laboratories' technical analysis efforts and other qualified programs. Its structure and data sources will be summarized. 2 refs., 1 fig.

58346 **(UCRL—97617) Interactive access to scientific and technological factual databases worldwide.** Hampel, V.E.; Grubb, D.P.; Moulik, A. (Lawrence Livermore National Lab., CA (USA)). Oct 1987. Contract W-7405-ENG-48. 25p. (CONF-881030—2). NTIS, PC A03/MF A01. Order Number DE88016172/JAW.

From Metallurgical Society fall meeting; Cincinnati, OH, USA (10 Oct 1988).

We describe the performance of the Intelligent Gateway Processor (ITP) as a technical and cost-effective tool for inter-connectivity among heterogeneous resources on geographically distributed networks. The IGP software has been evaluated by several federal agencies and is now operational on over 100 UNIX-based computers from 14 different vendors in the NATO countries and in the United States. We then discuss the IGP capabilities, especially the flexibility and extensibility of the table-driven, interpreter-based system that permits the development of a unified approach to the management of scientific and technological information. This includes the automated interactive access to the large bibliographic databases worldwide, the extraction of relevant sets, compilation into a neutral data exchange format, and trend analysis of emerging technologies by statistical means and time-resolved pattern recognition. The expanding availability of numeric factual databases in science and engineering now also makes it possible to evaluate the leading Chemical Information Management Systems (CIMS) which provide specialized interfaces to the chemical bibliographies and the nomenclature and structures of substances. We review four of the powerful and sophisticated commercially available CIMS in anticipation of their integration with gateway technology: MACCS and DATACCS from Molecular Design Limited in San Leandro, California, the DARC system from Telesystemes Questel in Paris, France, and the CENTRUM interface for the machine-aided preparation of chemical reports and graphics from Polygen Corporation in Waltham, Massachusetts. The IGP software had been under development since 1975 by the Technology Information Systems Program (TISP) at the Lawrence Livermore National Laboratory and is now licensed to industry. 51 refs.

58347 **Position, rotation, and intensity invariant recognizing method.** Ochoa, E.; Schils, G.F.; Sweeney, D.W. US Patent Application 6-096,434. 15 Sep 1987. 23p. Contract AC04-76DP00789. NTIS, PC A03/MF A01.

A method for recognizing the presence of a particular target in a field of view which is target position, rotation, and intensity invariant includes the preparing of a target-specific invariant filter from a combination of all eigen-modes of a pattern of the particular target. Coherent radiation from the field of view is then imaged into an optical correlator in which the invariant filter is located. The invariant filter is rotated in the frequency plane of the optical correlator in order to produce a constant-amplitude rotational response in a correlation output plane when the particular target is present in the field of view. Any constant response is thus detected in the output plane to determine whether a particular target is present in the field of view. Preferably, a temporal pattern is imaged in the output plane with a optical detector having a plurality of pixels and a correlation coefficient for each pixel is determined by accumulating the intensity and intensity-square of each pixel. The orbiting of the constant response caused by the filter rotation is also preferably eliminated either by the use of two orthogonal mirrors pivoted correspondingly to the rotation of the filter or the attaching of a refracting wedge to the filter to remove the offset angle. Detection is preferably performed of the temporal pattern in the output plane at a plurality of different angles with angular separation sufficient to decorrelate successive frames. 1 fig.

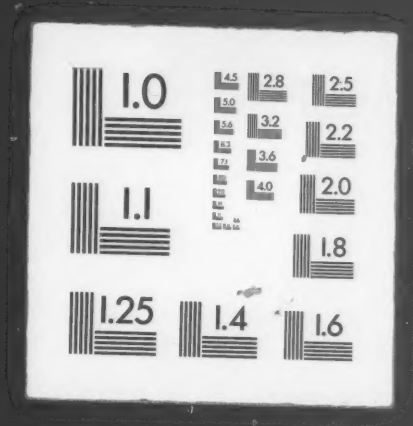
9904 Law

REFER ALSO TO CITATION(S) 56711, 56732

9905 Civilian Defense

58348 **(AD-A—195476/7/XAB) Report to Congress on the strategic defense system architecture.** (Strategic Defense Initiative Organization, Washington, DC (USA)). Jan 1988. 38p. NTIS, PC A03/MF A01.

The Services and SDIO are running parallel, complementary studies to evaluate sensor combinations for cost-effective operation in midcourse defense SDIO, in a national-level midcourse sensor study, is looking in depth at the possible contribution of the potential sensor platforms as a function of their configuration, location, and quantities. The Army is looking in detail at the contribution of GSTS (Ground Surveillance Tracking System) probes to the Phase I system. The results of these studies are due at the end of 1987 and will be analyzed and merged so that an informed decision can be made in early 1988. The SDIO Architecture contractors are doing in-depth analysis of the characteristics and performance of the baseline Phase I architecture with specific assumptions regarding its elements. The purpose of their work is to refine the operational requirements of the system and get more definition of the BM/C3. They are using both conventional and process description methodologies in their analyses and the tools they are developing will be passed on to the NTB Test Bed. The Architecture contractors are also supporting the SDIO midcourse sensor study.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